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New AR Directs Full-Scale Drive to Reduce Lead Time

Voting members of permanent Army General Staff Materiel Requirements Review Committee whose analysis of lead-time problems led to AR 11-25 are: left to right, Maj Gen H. H. Fisher, Assistant Deputy Chief of Staff for Military Operations, Chairman; Maj Gen Samuel L. Myers, Assistant Chief of Staff for Logistics, and Maj Gen Dwight E. Beach, Deputy Chief of Research and Development.

Profoundly considered procedures directed toward solution of one of the Nation's urgent problems, the reduction of lead time to insure that superior armaments and men trained to use them are ever ready for any emergency, are prescribed in a new Army Regulation.

AR 11-25 titled "Reduction of Lead Time" implements recommendations of a voluminous report on a wide-ranging study, conducted from February to August 1961, by a permanent Army General Staff Materiel Requirements Review Committee established by the Chief of Staff in 1951.

A primary objective of the program as outlined in the AR is to reduce lead time to "four years or less from project initiation to first production roll-off of materiel, followed by expeditious procurement in adequate quantities of selected items that make the greatest contribution to improvement in Army combat effectiveness."

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ARO-D Spurs In-House Creative Research by Grants

Stimulation of creative research through financial aid to small-scale investigators desiring to explore novel scientific concepts is the purpose of a new program announced by the Army Research Office in Durham, N.C.

Any Army scientist or engineer may apply, through his Commanding Officer, for a small amount of funds to finance research of possible value to the Army. Proposals are desired in the areas of chemistry, physics, mathematics, metallurgy, ceramics, and basic engineering, all of which are in the mission range of ARO-D.

Fund allocations as high as $8,000 may be made for a single project. In the case of requests for small amounts, not exceeding $3,000, the Chief Scientist or Engineer or Technical Director of the proposer's installation and the ARO-D staff may give approval with little delay. More investigation is involved for proposals involving in excess of $3,000.

Provisions governing the program include:

- The research is to be done during normal working hours, which are charged against the project.
- Funds may not be used in research for which the installation has funded mission responsibility, nor for feasibility studies on development of end

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Theme of the Month

By Dr. Richard A. Weiss
Deputy and Scientific Director, Army Research

A finely adjusted sense of balance is no more important to a tight-rope artist than it is to key administrators of the Army research and development program.

Balanced judgment evolved by melding of the best scientific brainpower within reach, balanced programing to phase into a practicable timetable basic, applied and engineering research, and balanced blending of capabilities within the Government in-house and outside scientific enterprises—all these are building blocks of research and development realistically shaped to the Nation's needs.

Maintenance of a high standard of in-house competence among our laboratory scientists and engineers is the critical component in linking military requirements to end products available for combat troops when needed. Only through this in-house capability is it possible to use the scientific resources of the Nation with a knowledgeable approach of how and where to achieve Army materiel objectives.

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4 R&D Scientists Earn SA Fellowship Awards

Four civilians employed at research and development Army installations received notice in mid-October that they have been awarded Secretary of the Army Research and Study Fellowships.

They are: Dr. John J. Antal, physicist at the Watertown Arsenal Laboratory, Mass.; Dr. Louis S. Baron, bacteriologist, Walter Reed Army Institute of Research, Washington, D.C.; Dr. Kiyoshi Higuchi, biochemist, Chemical Corps Biological Laboratories, Fort Detrick, Md.; and Roy C. Laible, chemist, Quartermaster Research and Enginering Laboratory, Natick, Mass.

Dr. Antal's proposed fellowship program is based on two factors—his present course of experimental research on the defect structures of solids, and results of his studies using the Army's first low-energy neutron research reactor, the Ordnance Materials Research Reactor dedicated at Watertown Arsenal in 1960.

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Army R&D Newsmagazine

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To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Theme of the Month

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Army R&D in-house personnel at the decision levels necessarily are bifurcated in their approach to problems. One avenue of thought must lead to R&D that can be accomplished most efficiently by using in-house resources. The other broad avenue of decision leads to outside scientific and engineering community resources best able to accomplish a task demanding special talents.

The pace of science and technology today is phenomenally swift. Maintaining this pace is an increasingly vast complex of R&D activities within the Department of Defense, industry, educational institutions and nonprofit firms.

Confidence in our defense strength comes from this broad base of scientific progress. But to insure constant superiority in weapons systems, equipment and skilled manpower, this base must be exploited fully. In-house capability is the key to successful exploitaiton of all known ways and means of accomplishing critical Army R&D tasks.

Continuity of service of skilled scientists and engineers over a period of years is essential to a cognizance of short, medium and long-range materiel requirements. No less essential is an almost encyclopedic knowledge of resources available to meet requirements.

Basic to the Army R&D program is the concept that it be a combined and integrated effort among the military, industrial organizations, universities and nonprofit research groups. Succinctly, it is for the scientist or engineer to determine, having carefully examined the military requirements, what job is to be done, where it could be done best, and when it has been done, to assure that it has been done in accordance with technical requirements.

Environmental and combat conditions under which military materiel must be used are severe at best and often torturous. Seldom is it possible to adapt industrial equipment, through simple modifications, to make it sufficiently rugged, simple to operate and maintain, and long-lasting to meet military requirements. Accordingly, complete specifications must be written, based on reliable knowledge of the peculiar needs of combat use.

In many instances established engineering and development procedures are not equal to the task of preparing production prototypes for new military equipment until gaps have been bridged in technical knowledge of material component requirements. When such gaps block progress, the utmost in skill in the many scientific disciplines often must be pressed into action.

Intimate knowledge of in-house scientists as to where these skills may be found quickly, acquired during years of coping with difficult problems, then becomes the indispensable, invaluable asset. In such cases, in-house R&D leaders constitute the catalytic agent that changes an imaginative, advanced concept into superior military hardware.

Fundamentally, one of the most important requirements in a laboratory is that of building and maintaining islands of competence in basic fields of technology serving the Army. Some of these fields, for example, are radar and its techniques, optics, infrared, acoustics, communications, the whole field of solid-state physics, chemistry, mathematics—literally all of the scientific and technical disciplines that serve national defense.

Frequently, the needs of the Army are unique. If the Army had no interest and did not pursue strong programs of basic and applied research, little could be expected to result from industry and universities in these areas. Good examples are the fields of chemical, biological and radiological warfare; the whole field of explosives phenomena; problems having to do with operations research as it relates to specific Army problems of logistics and operations; and in the area of human factors dealing with training, selection, leadership, morale and classification.

The Army's career service scientists and engineers, constantly aware of the requirements of the military, are alert to new techniques and new ideas as they arise in the Nation's scientific and industrial resources. Consequently, they are able to project this new knowledge into new equipment and new weapon systems development.

Nowhere is the importance of competence and know-how of Government in-house laboratory personnel more appreciated than in the industry whose job it is to convert detailed specifications into workable Army equipment. Army scientists and engineers command respect of their counterparts in industry and the universities when they can demonstrate not only internal competence in the fields with which they are concerned, but also can demonstrate exceptional ability to design and fabricate components and systems.

Increase in scientific knowledge currently is almost exponential. Coupled with the rapid expansion of the Nation's R&D complex, the growth of knowledge complicates the Army's problem of keeping abreast of all factors meriting consideration in deciding how to make the soundest investment of R&D funds. Less than one-third of R&D proposals submitted to the Army can be financed within the current rate of funding. Obviously, when the choices are many, careful and detailed study must be made of all possible factors before a decision commits resources to what could be a costly development program.

Experience of Army career service scientists and engineers in making the decision holding the potential of the greatest payoff cannot be over-evaluated, particularly when viewed with respect to the complex problem of reducing lead time from the inception of a new idea to delivery of military hardware to field troops. This task is indeed challenging. It tries the very best of the imagination, skill and ingenuity of the laboratory scientists and engineers whose job it is to make first contact with the lead-time problem and to eliminate, systematically, those areas which appear least fruitful.

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New AR Directs Full-Scale Attack on Lead-Time Problem

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That objective assumes significant stature in view of the Committee's report that a study of 23 selected Army materiel items reflected an average total lead time of 10 years and 10 months. The report said "experience factors taken from previous studies show a rather constant overall average lead time of 8 to 12 years."

(Note: Lead time in the Army survey was computed from the date the item was first funded or the date the requirement was established, whichever was earlier, to the date the item was available to the Active Army.)

Chaired by Maj Gen H. H. Fisher, Asistant Deputy Chief of Staff for Military Operations, the General Staff Committee included Maj Gen Samuel L. Myers, Assistant Deputy Chief of Staff for Logistics, and Maj Gen Dwight E. Beach, Deputy Chief of Research and Development. Nonvoting members were Maj Gen Louis T. Heath, U.S. Continental Army Command, and Brig Gen Robert N. Tyson, Office, The Comptroller of the Army.

Functional jurisdiction of each of the Army agencies responsible for implementing the reduction in lead time program is expressly delineated by AR 11-25.

Standardization of management systems throughout the Technical Services, for example, is the prime responsibility of The Comptroller assisted by the Deputy Chief of Staff for Logistics and the Chief of Research and Development. The AR charges them to assure that the systems "remain standardized."

Establishment of a standardized information service "for all materiel programs in the development and production cycles as a central service for all Army Staff agencies" is fixed by the AR as another responsibility of The Comptroller.

"Each agency involved with materiel," the AR states, "will take direct and forceful action to reduce lead time," utilizing the most modern management techniques and tools. It is further stated that:

"Production and distribution lead time factors will be reduced by early concurrent preparations for production, accelerated production rates, and completion of integrated programing to permit uninterrupted distribution of the new item with required support and trained personnel."

In compiling its findings the General Staff Committee functioned with the assistance of a Working Committee composed of Lt Col Gordon E. Sayre, ODCSOPS; Lt Col Edward L. Smith, OCRD; Maj Edward F. Callanan, ODCSLOG; Maj Alfred J. Grigsby, USCONARC; and Claud C. Ham, Office of The Comptroller of the Army. Lt Col Allen L. Myers, ODCSOPS, served as secretary.

Past efforts to solve the lead-time problem and examples of what were considered good and bad programs were outlined in detail to the Committee at the outset by major divisions of the Chief of Staff and US CONARC. Briefings by each of the Technical Services followed, giving the Committee an insight into their current programs and needs.

Nonvoting members of General Staff Committee and Chairman of Working Committee of lead-time study are Maj Gen Louis T. Heath, USCONARC, Brig Gen Robert M. Tyson, OCA, and Lt Col Gordon E. Sayre, ODCSOPS.

Selection of the 23 past and current Army R&D projects for case study was based on high tactical value to the Army, high priority items to show specific administrative procedures aimed at lead time reduction, and representation of the Technical Services and combat arms to permit comparison of procedures. Preliminary information from these agencies was obtained by a survey questionnaire.

Next the Committee selected 4 of the 23 projects for full field visit studies, including comprehensive briefings by the Technical Services and the combat arms, to determine the good and bad points in lead-time procedure.

Considerations included: successive specification factors, early participation by the user, telescoped (concurrent and consolidated) testing, adequate and inadequate funding, funding delays, timely or delayed decisions, stable and changing requirements.

Further studies covered problems associated with product engineering, time estimates, coordination with other services, Congressional inquiries, changes occasioned by engineering test/service tests, strikes, the multitude of participating agencies, and external pressure causing expedited spectator decisions.

Additional information was obtained in briefings by top officials of the other Armed Forces and key military officers of France, the Netherlands, the United Kingdom and Sweden regarding their methods of reducing lead time. Five major U.S. industrial firms also briefed the Committee concerning their lead-time procedures. The Army Chief of Staff for Intelligence apprised the committee of what is known about lead-time procedures in the Soviet Union, generally credited with lead time of about five years.

As the end product of this intensive study, AR 11-25 is considered the most aggressive attack on the lead-time problem ever undertaken by the Department of the Army. Delegated to the Deputy Chief of Staff for Military Operations is the primary staff responsibility for preparing a "definitive phased Army Long-Range Capabilities Plan covering successive objectives for 20 years."

Commencing with the current year, this plan is to specify the materiel, fiscal and personnel aspects of the equipment, organization, and concepts adopted to reach each objective within foreseeable resources. It is to be sufficiently detailed to "tie together and form the basis for all other short, mid and long-range plans which will be coordinated with this overall plan."

In establishing time phasing of development, production and distribution of new materiel and all fiscal and personnel aspects of the organizations and materiel, the plan will:

- Provide a line of balance between the various Army programs.
- Point out wherein courses of action are not feasible.
- Be realistic and based on capabilities and expected assets.
- Allow rapid analysis [through extensive use of automatic data processing systems] for determining the feasibility and desirability of initiating a new materiel development.
- Point up quickly the assets or shortages of personnel and of funds for development, production and support.
- Provide an accurate basis for the defense of all Army programs within and above the Department of the Army.

AR 11-25 specifies that the Deputy Chief of Staff for Military Operations has primary staff responsibility to determine the total feasibility of each major research and development systems requirement.

Similarly, the Chief of Research and Development "will determine technical feasibility to develop and produce the item within the time available to include accurate costing techniques from initiation of the project through purchase of acquisition objectives and determine the capability of supporting the project within foreseeable RDT&E levels."

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ARO-D Emphasizes In-House Creative Research by Grants

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items or components, test equipment, etc., normally financed under established projects.

- Support may be continued only until the idea produces evidence of value to justify formal support under a specific funded project, or until the idea is proved unfruitful.
- Generally, the project should be completed in six months though a standard time limit of one year is set for expenditure of funds. (If extra time is needed in the interest of maintaining high quality in the research, it can be arranged.)
- The proposer need not already have a publication record in the area of the project and he may, if it appears advantageous, budget some of the fund for visiting scientists or engineers who may possess helpful information.

Within two months after completion of the research, the proposer must submit a written final report which should be sufficiently detailed and documented so that a person who later conceives the same idea will not repeat the exploratory work. Interim reports also may be submitted.

Scientists and engineers desiring to submit proposals for funding of research projects as prescribed in the ARO-D program should prepare a military letter addressed through channels to the Commanding Officer, ARO-D, attention of the Deputy Chief Scientist.

The application memorandum must describe the proposed research, name the chief investigator, outline his qualifications, state how he plans to proceed, predict the time required, contain a budget, and suggest the probably total funding required.

An application may be filed at any time during the fiscal year, for work to start at any time in the year. Funding of promising proposals will be effected promptly as long as funds are available.

The program is being monitored by Dr. Sherwood Githens, Jr., Deputy Director, ARO-D. Requests for more detailed information may be addressed to him at Army Research Office, Durham, N.C.

Stahr Calls for Balanced Army R&D Program

Secretary of the Army Elvis J. Stahr, jr., and Army Vice Chief of Staff General Clyde D. Eddleman keynoted the theme "Balanced Military Power Through Science and Industry" at the 16th annual meeting of the Armed Forces Chemical Association in Washington, D.C.

"I think one of our most important objectives—one that would give us the fighting tools we need and save money at the same time—is the attainment of a proper balance between basic research, applied research, and development," Stahr said. "We need to know as soon as possible when, idea-wise, we are headed up a blind alley and when—financially speaking—we are throwing good money after bad. . . .

"There is another promising road to increased economy in a field that most directly affects the representatives of American industry and Army men who work closely with them. I am thinking of the economy which results from long-range planning in the research, development, and production of the numerous and complicated instruments which our Army needs. I am thinking most particularly of the kind of far-sighted planning that helps us avoid unprofitable side roads and time-consuming excursions into unrewarding ventures. . . .

". . . The President and Congress have not handed the Armed Forces a signed blank check. They have, in effect, given us a promissory note which is negotiable only when we have determined and can show what our essential military needs are . . . The money we have at last been given for weapons, equipment, and maintenance must be spent with imagination, discrimination, and good old-fashioned cold calculation."

General Eddleman, noting the importance to our military preparedness of the exchange of ideas among military planners and members of industry, said:

"Both industrial and military research and development should devote increased effort in the exploitation of the new frontiers found in basic research. I know that industry has advanced many highly imaginative proposals to the Army. In consonance therewith, our military planners are attempting to provide proper guidance to industry's research and development community on the Army's needs for new weapons and equipment . . .

"We must continue to work together in reducing overall lead time to the absolute minimum. This factor is particularly important in the present era of scientific and technological growth—a period in which we cannot afford to lag behind in translating good research ideas into functioning military hardware."

Army Accelerates Production Of Frontline Combat Vehicles

Two contracts providing for the first production on an accelerated basis of the T114 armored reconnaissance carrier, the T195E1 self-propelled light howitzer and the T196E1 self-propelled medium howitzer have been awarded by the Army.

These vehicles are designed to furnish frontline troops improved tactical capabilities over vehicles they will replace. The T114 is an armored, lightweight, full-tracked vehicle designed for command and reconnaissance missions. It is air-transportable, air-droppable, amphibious, and weighs only 13,500 pounds combat-loaded.

The 195E1 105 mm. howitzer and the T196E1 155 mm. gun are both full-tracked weapons, which will replace vehicles used in the Korean conflict.

The contracts were awarded to the Cadillac Motor Car Division of General Motors Corp., developer of the three vehicles. Production will be performed in the Government-owned contractor-operated Cleveland Ordnance Plant, Cleveland, Ohio, and the Cleveland Ordnance District will administer the contracts.

New AR Prescribes Lead-Time Responsibilities

(Continued from page 3)

Relative to RDT&E the new Regulation requires that basic and applied research and component development will have broad objectives to:

- Gain and maintain a broad base in basic and applied research with which to provide the requisite state-of-the-art for support of systems developments and provide a sound basis for determining, before initiation of projects, the technical feasibility, time required, and cost of the project.
- Minimize the need for state-of-the-art breakthrough as a part of future systems developments.
- Preclude costly parallel approaches as a part of future systems developments.
- Provide major technological advances needed to gain and maintain qualitative superiority in materiel.
- Assure that applied research and component development programs are fully responsive to military requirements.

AR 11-25 constitutes the first comprehensive effort within the Department of Defense to present a complete package program aimed at reduction of lead time. As stated in its purpose and scope:

"These regulations set forth responsibilities, objectives and specific actions required by the Department of the Army which will contribute to a reduction of lead time from inception of an idea for materiel to equipment in the hands of U.S. Army troops."

Complete dedication by all agencies concerned in carrying out provisions of AR 11-25 is expected to achieve its desired goal as stated earlier:

"The lead-time objective of the Army is four years or less from project initiation to first production rolloff of materiel, followed by expeditious procurement of adequate quantities of selected items that make the greatest contributions to improvements in Army combat effectiveness."

Four R&D Scientists Earn Secretary of Army Fellowships

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In his year of research and study Dr. Antal proposes to spend nine months at the Centre d'Étude de l'Énergie Nucléaire at Mol, Belgium, and the remainder of the time visiting laboratories and experts in England, Norway, Germany, France, and Italy.

Dr. Antal, 35, received his B.S. degree in physics from the University of Scranton, and his M.S. and Ph.D. degrees from the University of St. Louis. He first came to Watertown Arsenal in May 1952. Shortly afterward he was appointed Guest Associate Physicist at the Brookhaven National Laboratory and served there on permanent assignment from Dec. 1952 to Feb. 1957.

His published work includes six articles in physics journals, two contributions to bound volumes and a number of Materials Research Laboratory reports. He was graduated *magna cum laude* from the University of Scranton, is a member of Sigma Xi, honorary research society, Phi Mu Epsilon, honorary mathematics society, the American Physical Society and American Crystallographic Association. He is listed in *American Men of Science.*

Dr. Baron, 37, Chief of WRAIR's Department of Bacterial immunology, intends to spend six months collaborating with Prof. Joshua Lederberg, Chairman of the Department of Genetics, Stanford University Medical Center, Palo Alto. Prof. Lederberg is a Nobel Prize winner in biology and medicine, and their studies will be in the genetics of sex and virulence in Salmonella. (See August issue, page 11.)

Dr. Baron received his B.S. degree from City College of New York, and M.S. and Ph.D. degrees from the University of Illinois, where he was a teaching assistant from 1949 to 1951. His academic honors include membership in Sigma Xi and Phi Sigma and an E. R. Squibb & Son Fellowship.

Associated with the WRAIR Division of Immunology since 1952, Dr. Baron is coauthor of some 20 articles published in professional journals, mostly dealing with Salmonella. He has served as Army representative with the Genetics Section, U.S. Public Health Service, National Institutes of Health, and as a member, Subcommittee on Maintenance of Genetic Stocks, National Science Foundation. A member of nine scientific organizations, he has given special lectures in microbial genetics at the Department of Microbiology and Public Health, George Washington University, Washington, D.C. In 1960 he received the annual Award for Scientific Achievement in the Biological Sciences of the Washington Academy of Sciences.

Roy C. Laible
QM R&E Laboratory

Dr. John J. Antal
Watertown Arsenal Laboratory

Dr. Louis Baron
WRAIR, Washington, D.C.

Dr. Kiyoshi Higuchi
CmlC Biological Laboratories

Dr. Higuchi, 44, presently supervisor of a project group devoted to basic studies in tissue culture physiology, will spend a year studying in Japan. Eight months of research will be in the laboratory of Dr. Osamu Hayaishi, Chairman of the Department of Chemistry at Kyoto University and international authority in the area of microbial metabolism.

An honor graduate of the University of Utah, with an A.B degree, Dr. Higuchi was awarded his M.S. and Ph.D. degrees by the University of Wisconsin. He has been employed as biochemist at Fort Detrick since 1948.

Dr. Higuchi is coauthor of a number of articles published in the *Journal of Bacteriology* and has presented several papers at national meetings of the Society of American Bacteriologists. In October 1959 he was awarded a citation for outstanding performance of duties at Fort Detrick.

Mr. Laible, 36, a physical science administrator at the QM R&E Center, plans to study the time dependent stress-strain properties of several new fibers during a year divided between the University of Glasgow, Scotland, the Swedish Forest Products Research Laboratory, Stockholm, and Directorate of Stores and Clothing Development, Royal Aircraft Establishment, England.

A graduate of Northeastern University, from which he received a B.S. degree, Mr. Laible was awarded an M.A. degree from Boston University and has studied at Georgetown University and the Massachusetts Institute of Technology. He is author and coauthor of a number of articles published in technical journals.

Fluid Amplifier Pulses Flow of Experimental Heart Pump

Principles of fluid dynamics, permitting control of energy sources without use of moving parts, are unveiling exciting possibilities in the Army's search for a greatly improved low-cost heart pump.

Research initiated at the Army Diamond Ordnance Fuze Laboratories and now pursued jointly with the Walter Reed Army Institute of Research in Washington, D.C., has produced an experimental prototype heart pump controlled by a fluid amplifier block.

Inventor Kenneth E. Woodward, 33, commented during a demonstration that the machine has functioned satisfactorily in tests since it was placed in operation in February 1961. But he was quick to emphasize that research still is in the early phase, and that certain problems may not be easy to solve.

A glimpse into the long-range goal of Woodward's project is given by DOFL Technical Manual 640-1-61 titled "A Study and Proposal for an Artificial Heart Using Interacting Fluid Techniques," dated Feb. 23, 1961.

Queried about how hopeful he is regarding the possibility of developing an artificial heart using fluid controls to replace an irreparably sick human heart, Woodward responded:

"That's just a dream yet—a dream beset by so many complex problems that it may never be more than that."

Prominent among the artificial heart problems is the finding of reliable materials that will permit design of a heart the same shape, size and weight as the human heart. Components must be chemically inert, immune to clotting elements of the blood, noncancer producing, allergy-free and easy to suture

Maj Timothy G. Barila, Chief of WRAIR's Department of Resuscitation, and his asociates working with the DOFL team are confining efforts for the present, and possibly for an extended period, on developing the heart pump.

Animal tests using the new pump are expected to begin within a few weeks, with the goal of perfecting design principles for a production prototype in February or March 1962, followed by further animal tests.

Results of experiments to date suggest that blood hemolysis, one of the major problems of open-heart surgery using presently available types of heart machines, is greatly reduced by the DOFL-WRAIR pump.

Elimination of moving parts, except for articificial ventricles and tricuspid heart valves, contributes to this lessening of blood damage. Other pumps employ electric motors, electromagnets, hydraulic parts or similar moving components.

Blood pump inventor Kenneth E. Woodward, standing beside working model of the instrument, holds amplifier which powers, controls blood flow.

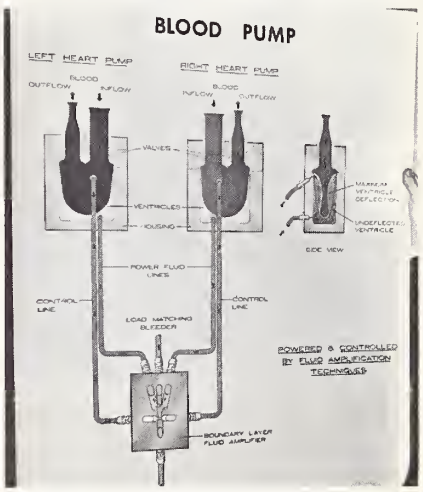


Diagram of Woodward blood pump depicts its heart-analagous operation.

Advantages of the experimental machine noted by Mr. Woodward include:

- It pumps in a manner similar to that of the heart, with systolediastole (squeezing - relaxing) characteristics. It senses pressures and produces an output flow that is related to the venous pressures.
- Two pumps can be made to operate simultaneously or alternately, with automatic regulation of flows between the pumps without moving parts or electronics.
- Excellent reliability and life characteristics are indicated.

Principles of fluid dynamics controls were developed by a trio of Diamond Ordnance Fuze Laboratory scientists, Billy M. Horton, Dr. Romald E. Bowles and Raymond W. Warren, in 1960 as the culmination of several years of research. (See February issue, page 22.) Since then the tremendous potential of low-cost fluid controls in industry has stirred worldwide interest.

In August 1960, Wilbur S. Hinman, Jr., Technical Director of DOFL, asked the development laboratories to begin considering possible applications of fluid amplification. In September Dr. Bowles suggested to Mr. Woodward that a study be made of the possibility of using fluid controls in a pump to lessen damage to blood in heart pumps used in open-heart surgery.

Employed at DOFL since January 1955, as a mechanical engineer concerned with packaging development, Woodward was eager to try his talents in creative research. Graduated from George Washington University in 1949 with a B. Mech. E. degree and from the University of Maryland in 1953 with a M.S. degree, he had worked with the Naval Research Laboratory in Washington and then with the O. S. Peters Co. as a junior mechanical engineer. In 1960 he received his M.E.A. degree from George Washington University.

Without a working knowledge of fluid amplification principles, and without any background in medical science and the precise details of the intricate functioning of the human heart, Woodward plunged into his task. From September to January he visited hospitals and individuals concerned with heart-lung machines and artificial heart development in various parts of the United States.

Until June 12 Woodward worked alone in developing the design and the prototype of the heart pump, except that he needed the help of a plastics technician in producing the delicate artificial ventricles and tricuspid heart valves. Roy High met this requirement. Next to join the team was George Mon, 27-year-old mechanical engineer born in China.

A week later, on June 19, Henrik Straub, 22 years old, born in Germany, completed the team. Straub, son of DOFL physicist Dr. Harold W. Straub, who brought his family to the United States in 1954, is scheduled to graduate in February 1962 from the University of Maryland with a degree in aeronautical engineering.

Products of DOFL's summer training program for university students, Mon and Straub have made what Woodward termed a "valuable contribution" to the heart pump research with their system tests and evaluation of the prototype design.

ADVANTAGES—FLUID INTERACTION TECHNIQUES

- **CLOSE DUPLICATION OF HEART FUNCTIONS**
  - PULSE SHAPING
  - NO SUCTION
  - ALTERNATE OR SIMULTANEOUS PULSING
  - VARIABLE FLOW RATES
  - LIGHTWEIGHT
  - LOW NOISE LEVELS
- **EXCELLENT RELIABILITY AND LIFE CHARACTERISTICS**
  - LOW STRESS
  - SIMPLE POWER SUPPLY
  - NEGLIGIBLE MAINTENANCE
  - NO LUBRICATION
  - MINIMAL MOVING PARTS
- **SIMPLIFIED PACKAGING**
  - FEW SEALING PROBLEMS
  - SUFFICIENT CONTROLLED ENERGY
  - VOLUMETRIC EFFICIENCY
  - FORM FACTOR FLEXIBILITY
  - NO HEAT PROBLEMS
  - EASY TO STERILIZE
  - FLEXIBLE MATERIAL SELECTION
- **LOW END PRODUCT COST**

During an interview Woodward gave the impression of carefully guarding against over-optimism regarding the potential payoff of his invention, but it was difficult for him to suppress that he is driven by high hopes soundly based upon his findings to date. He appeared calmly confident that the heart pump will pass all tests and that it can be produced at very substantially lower cost than present machines priced in the area of $40,000.

For a young man actively engaged as a research scientist for only a year, working on a project that could result in tremendous benefit to the civilian scientific community as well as to soldiers in the field requiring heart surgery, Woodward appears unusually gifted to pursue to successful fruition a challenging task.

Army Antimalaria Pill OK'd For General Issue to Troops

Successfully field tested in Korea, an antimalaria pill developed by the Army Medical Service this month became a standard item of supply to the Armed Forces.

A combination of chloroquine and primaquine, the pill (unnamed as yet) is the result of studies conducted by Dr. Alf S. Alving of the University of Chicago under contract with the U.S. Army Medical Research and Development Command, Washington, D.C. (See January issue, page 13.)

The new tablet simplifies malaria prevention. Formerly chloroquine was administered in weekly dosages to patients in malarious areas, followed by a dosage of primaquine for 14 consecutive days upon leaving the area. The new pill is taken only once a week while in the malarious area.

An additional improvement in the new tablet is the development of a coating which disguises its bitter taste, an objectionable feature of both the old chloroquine tablet and the first of the chloroquine-primaquine tablets.

Van Allen Gets Cresson Medal For 'Pioneering Achievements' In Exploring of Upper Space

For his "pioneering achievements in the field of space science," Dr. James A. Van Allen was awarded the Elliott Cresson Medal by the Franklin Institute of Philadelphia on Oct. 18.

During the International Geophysical Year Dr. Van Allen discovered the radiation belts around the earth which now bear his name. His discovery stemmed from observations made during the orbit of an Army EXPLORER satellite in which he had installed instrumentation.

Now head of the physics department at Iowa State University, Dr. Van Allen worked at the Johns Hopkins Applied Physics Laboratory, Md., 1942-50. He headed the upper atmosphere research program there and devoted much time to the study of cosmic rays. In 1946 he made the first measurement of primary cosmic ray flux at high altitude.

ARTS Reports Status of 3,000 Research Tasks

An overall insight into the status of Army research activities at the close of Fiscal Year 1961, involving approximately 3,000 tasks, is given in the Army Research Task Summary (ARTS) scheduled for distribution in the near future.

The first two volumes of the 7-volume summary are expected to be off the press within two weeks and the others will follow before the end of December.

Automatic distribution will be made to Department of Defense and other Government agencies concerned. A change from the former system of making the ARTS available to the public through sale by the Office of Technical Services, Department of Commerce, has been effected. Public sale this year will be handled by the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Prices and catalogue numbers were not available at press time.

Containing more than 3,500 pages of highly condensed data, and representative of a five percent increase in the number of tasks as compared with the previous summary, the new ARTS has an improved index. For the first time, tasks are listed by contract number as well as by titles, the principal investigator, subject matter, and the installation performing the research.

Tasks are separated according to scientific discipline into six unclassified volumes:

No. 1, Life Sciences and Psychological and Social Sciences; No. 2, Chemistry; No. 3, Physics; No. 4, Engineering Sciences and Earth Sciences; No. 5, Materials; No. 6, Electronics, Mathematics, Operations Research, Planning and Systems Research, and Interdisciplinary Research; and No. 7, the Index.

The ARTS has been compiled each year since 1955 by a George Washington University Task Group under direction of Col Harold P. Hennessy (USA-Ret.).

$171,821,000 Contract Let For NIKE ZEUS Development

Continued development of the NIKE ZEUS anti-missile-missile system for an additional 12 months is called for in a $171,821,000 contract awarded by the Army to the Western Electric Co.

Some of the funds in the new contract will be spent for work at major test sites for the missile defense system. Components are being tested at Ascension Island in the South Atlantic, at Bell Laboratories, at the Army's White Sands Missile Range, N. Mex., and at the Pacific Missile Range Headquarters, Point Mugu, Calif.

The fifth and largest site, a complete NIKE ZEUS installation, is nearing completion on Kwajalein Island in the South Pacific. NIKE ZEUS missiles will be fired and controlled from Kwajalein in tests against targets launched from Vandenberg Air Force Base.

Theme of the Month

(Continued from page 2)

National security aspects—the effective safeguarding of classified data—are closely interwoven in the fabric of informational requirements of military R&D, and not only insofar as relates to knowledge of the critical factors and resources within the United States.

Equally complete knowledge of the R&D capabilities of our Free World allies, so that international integration of effort can be accomplished expeditiously when feasible, is no less vital. Paramount is the importance of keeping constantly informed about weapons systems of the potential enemy, as the first crucial step toward designing and producing, ever in advance of that enemy, superior armament and personnel trained to use it.

Adequate protection of security aspects of military R&D can be built only around the bulwarks of a soundly organized force, well fortified against disruptive work factors, of Government in-house sientists, engineers and administrators—representative of the highest professional skills and loyally dedicated to an immense task.

Academically, it is essential that the Army's internal R&D effort, be it basic research, supplied research, or development, should be every bit as competent as that expected from the outside scientific community. In many instances, as a matter of record, the competence of Army R&D personnel has been and continues to be superior to outside science resources.

A great many scientific innovations and new equipment have sprung from the imaginative thinking linked with carry-through competence of Army scientists and engineers. Moreover, they have possessed the intuitive judgment, backed by confidence based on past results of the proposed investigators, in selecting significant projects conducted by outside scientists under Army contracts or basic research grants.

Perhaps one of the most impressive results of this intuitive judgment was demonstrated by the foresight of the Signal Corps Research and Development Laboratories in early support of work at Columbia University which culminated in award of the Nobel Prize in physics in 1955 to Kusch and Lamb for their work with the hydrogen atom. Technologies involved in their work were of great assistance to Professor Charles Townes in efforts which led to the gaseous maser, out of which evolved the solid-state maser and, recently, the optical laser.

Dr. Harold Brown, Diretor of Defense Research and Engineering, stated recently that "most of the Pentagon weapons development now is properly contracted to industry." But he added that "strong Government laboratories, staffed by first-class scientists, are needed for a number of reasons, including that of providing the Government with expert supervision over the big research and development projects let to industry."

Dr. Allan T. Waterman, Director of the National Science Foundation, announced on October 23 the establishment of a Science Resource Planning Office within the NSF headed by Dr. Richard H. Bolt, on leave from the Massachusetts Insittute of Technology. Dr. Waterman commented:

"The importance of scientific progress and the rapid growth of our science and technology call for increased abilities to analyze trends, to study the effects of Federal programs on the conduct of research and teaching in science, and to anticipate future demands on the Nation's science resources."

In my opinion, Dr. Waterman's view emphasizes that Government R&D laboratories must maintain and increase their capacity for retaining top quality scientists and engineers.

One of the best ways to do this is to provide young scientists and engineers the opportunity to work with other highly competent associates and particularly scientists of outstanding reputation and ability. This requires that in-house laboratories recognize that personal scientific and technical achievement belongs at the top of the list of desirable characteristics.

The Department of Defense has indicated in numerous ways recently that it places inestimable value upon the accumulated knowledge and specifically developed skills of career service R&D personnel. Lt Gen Arthur G. Trudeau, Chief of Research and Development, has taken various actions to provide for career development of in-house scientists and engineers. Further steps toward this goal will continue to have high priority.

David D. Bell, Director of the Bureau of the Budget, currently is charged with submitting to President Kennedy by December 1 a report on a thorough study of the feasibility of increased utilization of Government in-house R&D facilities. Drector Bell recently stated:

". . . I have no quarrel with some differential favoring the private economy. I believe in the efficacy of patriotism and the inherent interest of public affairs to help attract men to Government service. But the size of the salary differential which now seems to exist seems to be so large to make it quite difficult to attract and hold the ablest administrators, scientists and technicians in those crucial jobs in the higher levels of the career service. Everyone interested in effective management of the public business should . . . ponder this problem."

The increasing knowledge from our science and technology have thrown a major burden upon our military laboratories to develop highly skilled and specialized leadership. Responsibilities of this leadership, entrusted to career service scientists, engineers, technicians and administrators, may be separated into two main channels of activity: to set down the goals and objectives necessary to accomplish the military mission; to provide for knowledgeable and enlightened management of resources in the best interests of the Nation.

Key Scientists Schedule Special Warfare Meeting

A program centered on special warfare is scheduled for the 11th Meeting of Army Key Scientists at the Special Warfare Center, Fort Bragg, N.C., Dec. 6, 7, and 8.

Presentations will be made by representatives of the Office of the Deputy Chief of Staff for Operations, Office of the Assistant Chief of Staff for Intelligence, and by the Deputy Director of Intelligence for Special Warfare, OCRD.

The presentations will give general information on current efforts at the Department of the Army (DA) staff level to improve Army capabilities in special warfare. Speakers will also outline problems of interest to research and development organizations as seen from the DA level.

Meetings of Army Key Scientists are sponsored semiannually by the Chief of Research and Development. The meetings afford an opportunity for the Army's top scientists to exchange ideas and information on subjects of interest and to obtain information on the activities of various installations.

College Senior Acclaimed For Summer Work at ERDL

Robert K. Stevens, 20-year-old college senior majoring in political science, *who has worked the past three summers at the U.S. Army Engineer Research and Development Laboratories at Fort Belvoir, Va., has gained acclaim as a* practical scientist.

In recognition of the caliber of his work in the Demolitions and Fortifications Branch of the Mlitary Department, Stevens recently received a Certificate of Achievement and a letter of commendation.

The letter said, in part:

"You have shown ability to understand complex theoretical matter and, yet, retain the perspective necessary to devlop original concepts. Your field improvised propulsion system for an antitank missile is another contribution which is especially worthy of note. Your approach to the problems of innovation, fabrication and testing the device was remarkably effective. Your designs were original concepts created without similar precedent."

Stevens, who had the top scholastic average in his high school class, is scheduled to receive an A.B. degree in January 1962 from Kenyon College, Gambier, Ohio, in political science.

17 OCRD Officers Chosen For Promotion to Colonel

The Army has recommended 17 officers from the Office of the Chief of Research and Development for temporary promotion to Colonel.

They are: Ernest H. Davis, Oscar E. Davis, Robert L. Doupe, Wilford D. Gower, Frederick J. Hurley, Mont S. Johnston, Jr., Myton T. Johnston, David B. McFadden, Jr., Brooks O. Norman, George Sammet, Jr., and Houck Spencer, all of the Office of the Chief; Russell W. Ernst, newly appointed Chief of the Technical and Industrial Liaison Office; Merle L. Carey and Karlton Warmbrod, Army Research Office; Leroy D. Brummitt, Research and Development Operations Research Advisory Group, Bethesda, Md.; and John T. Newman and Herbert Richardson, Jr., USA Standardization Group, UK.

Army Contracts for Work On SATURN Test Facility

The Army has awarded a $15,190,000 contract for initial construction of the National Aeronautics and Space Administration's new launch complex for testing improved and more powerful models of its giant SATURN moon rocket.

The Army Corps of Engineers, construction agency for NASA, is supervising erection of the test facility at the Cape Canaveral, Fla., Missile Test Center. Blount Brother Construction Co., Montgomery, Ala., is the prime contractor.

A massive 300-foot-high mobile service tower will have a capacity for possible future extension to 330 feet. Facilities will be provided for the compression, storage and transmission of rocket fuels. A launch control center, instrumentation and communication equipment, an umbilical tower and other structures are included in the contract.

Construction at the new site will be spread over 120 acres, nearly twice the size of the present test area for the first model of the SATURN. Nov. 1, 1962 has been set as completion date.

ARO Man Named for President's R&D Study

Gregg H. McClurg has been appointed Army representative for a study being made of Government in-house laboratory capabilities of taking over more of the research and development activities presently assigned to private nonprofit organizations. Mr. McClurg is Scientific Adviser in the Research Planning Division, Army Research Office.

Following President Kennedy's request to the Bureau of the Budget for this review, the Army has been assigned to make case studies of: Research Laboratory for Electronics, Massachusetts Institute of Technology; Operations Research Office (ORO), Johns Hopkins University; Research Analysis Corporation, recently established to replace ORO; and the Human Resources Research Office at George Washington University.

Essential elements to be included in these studies are:

• A short history of each organization, including the part, if any, that the Department of Defense played in its initiation and justification for its creation.

• The nature and dollar value of current contracts, personnel procedures, and fees provided under each contract.

• Overhead rate currently negotiated and overhead allowances estimated for FY 1961, if available.

• Contractual provisions pertaining to patent rights.

Studies of 22 nonprofit organizations are scheduled to be completed by Dec. 1.

Participating in the studies are the Navy, Air Force, Department of Defense, Chairman of the Atomic Energy Commission, Chairman of the Civil Service Commission, Administrator of the National Aeronautics and Space Administration, and the Special Assistant to the President for Science and Technology.

Over 350 nonprofit corporations have been established in the past decade to perform Government services, mostly in the missile, electronics, and atomic areas.

Canadian Cable Evaluated For Frontline Operations

An ultralight communication cable designed for assault operations is under evaluation by the U.S. Airborne and Electronics Board, Fort Bragg, N.C.

The system is aimed at fulfilling the small unit commander's requirement for a dependable wire system person-to-person conversation.

Designed in Canada, the cable is capable of carrying one voice circuit over a maximum distance of two miles, using Telephone TA-1/PT or equivalent. Further, the cost is expected to be low enough to avoid the necessity of recovery or repair where faults are difficult to locate.

Modern tactical concepts require increased battlefield mobility, including wire systems that can be installed in a small fraction of the time now required, without undue logistic burden.

Operational use of the Canadian cable would be to provide quick point-to-point line communication to observation posts, patrols, forward observers and weapon positions.

Army Pathologist Reports on U.S.S.R. Science

Soviet medical scientists studying the effects of various hormones on tumors have found that androgens cause regression in 80 percent of their human breast cancers.

This is one of the numerous observations contained in a paper titled "Medical Education and Research in the U.S.S.R." written by Col Joe M. Blumberg, Deputy Director (Army) of the Armed Forces Institute of Pathology and Chief of the Pathology and Laboratory Sciences Consultant Branch, Office of The Surgeon General.

Presented at the annual meeting of the Association of Military Surgeons of the United States, held in Washington Nov. 5-8, the paper was prepard by Col Blumberg on the basis of a 3-week visit to the Soviet Union with two other American exchange pathologists.

Col Blumberg's observations on the Soviet use of hormones was made in the Laboratory of Experimental Hormone Therapy of the Institute of Clinical and Experimental Oncology, one of the leading Soviet cancer research institutes.

During a visit to the Institute's Laboratory of Virology, workers stated that results of studies on vaccines prepared from tumor tissues were not encouraging. In the Laboratory of Experimental Biotherapy workers were investigating the use of antibiotics in cancer, most of the work being done on mouse cancer, but with little success.

Col Blumberg and his colleagues visited the Laboratory of Organ Transplantation in the Moscow Medical Institute and saw large dogs which had been grafted on the chest with the head and shoulders of a small dog.

"One such graft appeared in good condition and both dogs were active," Col Blumberg noted in his paper. "The grafted head was very alert, and active Pavlov and pain reflexes were evident. When the ear of the large dog was pinched, the small dog snapped; when the large dog drank, the small dog made lapping motions. These transplants usually survive 20 to 22 days."

At the Emergency Hospital, where cadaver blood was first used for transfusions in 1932, Col Blumberg was told that to date some 60,000 pounds of blood have been used for this purpose without a single transfusion death.

Scientists at the Institute of Experimental Pathology and Oncology, in the Republic of Georgia, were studying prophylaxis against injury from irradiation, and were trying out many different chemicals as protective measures against the effect of X-rays, Col Blumberg noted.

"At that time (about two years ago) a new treatment introduced for irradiation sickness consisted of acetylcholine and adrenalin. With this combination of drugs 40 percent of the treated animals survived.

"They were also studying pathogenesis of irradiation effects and the changes in the various organs both grossly and miscroscopically. Whole-body irradiation produced the most marked changes, but individual organs were successfully screened out during the whole-body exposure. For example, they had studied some animals whose testes were screened, and no secondary effects were found from whole-body exposure."

In addition to its presentation at the Association of Military Surgeons meeting, Col Blumberg's paper was scheduled to be published in *Military Medicine*, official Association journal.

SERGEANT Passes Tests As CORPORAL Replacement

Final firings in the development program of the Army's SERGEANT Ballistic Missile System have been conducted at White Sands Missile Range, N. Mex., in preparation for readying the SERGEANT to replace the operational CORPORAL.

Successful firings recently tested the SERGEANT and its ground support equipment in simulated battlefield conditions. All test objectives were met. In one test, a SERGEANT was successfully fired from a mountain site and impacted on target several thousand feet lower and many miles distant in the desert.

The solid-fueled SERGEANT is a more mobile system than the CORPORAL; it can be set up and fired more rapidly under adverse conditions of weather and terrain by a smaller crew. Its inertial guidance system makes SERGEANT immune to known counter-measures.

One of the objectives of the final series of firings was to check firing procedures to be used in troop training.

SC Contracts for Delivery Of Vehicular Radio Units

The Army Signal Corps awarded a $65.8 million contract in October for AN/VRC-12 radio systems designed to meet the needs of the U.S. Army's armored, artillery and infantry units.

The system consists of a medium-powered receiver-transmitter, an auxiliary receiver and operational accessories. It provides for voice communications among tank and similar vehicles, command cars, and stationary command posts at distances of from 20 to 25 miles, over a large number of channels.

The VRC (Vehicular Radio Communication) system is extensively transistorized and miniaturized in special packaging that is both rugged and light. The VRC-12 unit weighs 102 pounds, a reduction of 48 percent from the currently used AN/GRC-3, -5, -7 series of tactical FM radio communications equipment.

The equipment is compatible with the man-pack, portable and airborne FM radio sets being developed by the Army for forward area use as well as the present standard series of tactical FM equipment, some having common frequency coverage.

Development of the new system was achieved through a contract with the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J. Avco Corp., Cincinnati, Ohio, is prime contractor.

Courses Started to Develop More Topographic Officers

Rapid growth of Armed Forces mapping and geodesy requirements has prompted the U.S. Army Corps of Engineers to launch a special course to train additional topographic engineer officers at the U.S. Army Engineer School, Fort Belvoir, Va.

Lt Gen W. K. Wilson, Jr., Chief of Engineers, said a recent study by his office showed an urgent requirement for officers to fill topographic engineer assignments in the Corps' "Defense-wide mission in geodesy, mapping and intelligence."

Positions include commanders and staff officers within topographic units, topographic staff officers in higher U.S. and allied command headquarters, and project officers in the Corps of Engineers worldwide mapping and geodesy programs.

The first group has started training. In future courses, planned to continue during the next few years, company or field grade officers will be selected. Preference will be given to those who have one or more of the three basic military occupational specialties related to topographic engineering. These are topographic surveying, photomapping, and map reproduction.

Sideband Radio Improved to Increase Versatility

An advanced engineering model of AN/GRC-106 Single Sideband Radio Set has been operated successfully from a ¼-ton M38 jeep 13 months after award of the development contract.

The set was field tested at General Dynamics Electronics (Military Division), Rochester, N.Y., plant by the Airborne and Electronics (A&E) Board and the U.S. Army Signal Research and Development Laboratory. First long-range contact was made with Mr. J. C. White, A&E Board engineer, Fayetteville, N.C.

The radio set features digital tuning and modular construction. It is rated at 400 watts, and can operate from any vehicle equipped with standard 24-volt generator and battery system.

Short range tests have been conducted in the Rochester area by Lt Col J. T. Dabinett, A&E Board, and E. Harrison, Chief Engineer of the AN/GRC-106, -107 program.

The single sideband program will provide the Army with highly reliable medium and long-range radio sets capable of operating on voice, continuous wave and teletype. Use of single sideband will permit a four-fold increase in the utilization of the frequency spectrum.

Lt Col J. T. Dabinett and E. Harrison discuss AN/GRC-106 performance.

The AN/GRC-106, -107 will replace the current standard AM sets, the AN/GRC-19 and AN/GRC-26D.

Panel Reviews Extreme Environments Mobility

Mobility in the earth's most extreme environments was considered at the 25th meeting of the Panel on Environmental Research. Sponsored by the Army Committee on Environment, the session was held at the U.S. Army Transportation School, Fort Eustis, Va., Oct. 16-17.

Rear Adm George E. Dufek (USN, Ret.), Commander of the Navy's Operation Deep Freeze during the International Geophysical Year, discussed "Environmental Operations in the Antarctic." Lt Col Merle R. Dawson, who figured prominently in the Army's IGY research in the Antarctic and is now with the U.S. Army Transportation Board, was another featured speaker.

Dr. Carl R. Eklund, Chief of the Polar Branch, and Dr. Lester W. Trueblood, Chief of the Tropical Branch, Army Research Office, OCRD, outlined the Army's 5-year programs in the polar, tropic and desert regions.

Maj Gen N. H. Vissering, Commander of the U.S. Army Transportation Command, and Brig Gen R. B. Neely, Commandant, U.S. Army Transportation School, joined in welcoming the Panel members.

In discharging its mission of coordinating findings and recommendations with other military departments, civilian agencies and programs of the Canadian Defense Board, the Panel on Environmental Research recently held a meeting at the Electronics Proving Ground at Fort Huachuca, Ariz. It is the Panel's intention to review work in progress at major environmental research facilities.

Facilities visited to date inculde the Quartermaster R&E Command at Natick, Mass.; Chemical Corps Proving Ground, Dugway, Utah; Engineer Corps Waterways Experiment Station, Vicksburg, Miss.; Arctic Test Board, Fort Greely, Alaska; Ordnance Corps Proving Ground, Aberdeen, Md.; Signal Corps Research and Development Laboratory, Fort Monmouth, N.J.; Army Medical Research Laboratory, Fort Knox, Ky.; Canadian Defense Research oBard, Ottawa.

Beverly Nominated for B.G., Succeeded in ARO by Shultz

Col. William M. Beverly, who served as Assistant Director of the Army Research Office, OCRD, since early in 1961, has been reassigned as Division Artillery Commander of the 2nd Armored Division, Fort Hood, Tex.

Before leaving Washington, D. C., in mid-October, Col Beverly was nominated by President Kennedy for promotion to the grade of brigadier general. Succeeding Col Beverly as Assistant Director ARO is Col Vester M. Shultz, former senior military adviser to the Operations Research Office, predecessor of the Research Analysis Corporation.

A 1939 graduate of the U.S. Military Academy at West Point, Col Shultz attended the Command and General Staff College (1946), British Army Staff College (1949), and the U.S. Army War College (1955).

From 1939 to 1945 he served in grades from second lieutenant to lieutenant colonel in the 6th Inf Div Arty; for two and a half years of this period he was Field Artillery Battalion Commander in World War II, with service in Hawaii, New Guinea and the Philippines.

His assignments since have included, 1945-48, instuctor at the Artillery School, Fort Sill, Okla.; 1949-1952, Standardization Group, London, England; 1952-1954, Executive, Gunnery Department, Fort Sill; from 1955, when he was promoted to colonel, to 1958, U.S. Army attache, U.S. embassy, Ottawa, Canada; 1958-1960, Nike Air Defense Group Commander, New Britain, Conn. He joined ORO in 1960.

Trudeau Hails Patent System on 125th Anniversary

American Patent System Week, designated by joint resolution of Congress as the week of Oct. 15 to commemorate the 125th Anniversary of the Patent Act of 1836, was noted by Lt Gen Arthur G. Trudeau, Chief of Research and Development, in the following letter:

Honorable David L. Ladd
Commissioner of Patents
Dear Mr. Ladd:

On the occasion of the 125th Anniversary of the Patent Act of 1836 I am pleased to extend to you and your staff heartiest congratulations from the Department of the Army.

During my present assignment as Army Chief of Research and Development, I have had a particularly good vantage point to observe the significant role the Patent System has played in stimulating inventions and the rapid advance of technology so necessary to the continued strength of our national defense and to the discharge of our ever-growing international responsibilities. We, in the Army, are proud of the American Patent System as well as the administrators of that system whose loyalty, integrity and devotion to duty during the past century and a quarter have developed and maintained its present high standards for advancing the sciences and useful arts.

As a native of Vermont, the home state of Samuel Hopkins who received the first United States patent, I am particularly pleased to indorse personally the observance of this celebration of the system which, through the years, has carefully nurtured the tradition of Yankee ingenuity demonstrated so early in our nation's history.

I wish you every success in bringing the growing importance of the Patent System to the attention of the general public.

Dr. Keats A. Pullen, Jr.

AIEE Fellowship Awarded To Army Electronic Expert

Dr. Keats A. Pullen, Jr., an electronic electrical engineer at the U.S. Army's Ballistic Research Laboratories, Aberdeen Proving Ground, Md., has been awarded a fellowship in the American Institute of Electrical Engineers.

The award was made on the basis of Dr. Pullen's outstanding contributions in research and writing in the electrical engineering field. His accomplishments include three textbooks, two sections of a science and technology encyclopedia, a number of BRL reports and numerous engineering articles contributed to technical magazines and journals.

AIEE fellowships are awarded to less than five percent of the 56,000 membership of the Institute. Prerequisites include 15 years' practice in the engineering field, five years in a supervisory capacity, and distinction in an individual field, including some particularly outstanding contribution in that field.

Ordnance Scientists Discuss R&E Management Procedures

Management policies and procedures in research and engineering conducive to the greatest possible progress in Army weapons for national defense were discussed recently by 22 top-level Army Ordnance senior scientists.

Host for the meeting at Boonton, N.J., was Col Russell R. Klanderman, Commanding Officer of Picatinny Arsenal, Dover, N.J., Research and Engineering Center of the Ordnance Special Weapons—Ammunition Command.

Dr. George Lee, Chief Scientist on the staff of Lt Gen J. H. Hinrichs, Chief of Army Ordnance, was chairman. Participants represented all principal research agencies of the Ordnance Corps.

Maj Gen William K. Ghormley, Commanding General of the U.S. Army Ordnance Special Weapons—Ammunition Command, was a speaker.

Key Officers Training On PERSHING System

Key Army military and civilian personnel have begun intensive training courses in the new PERSHING ballistic missile system at Orlando, Fla.

Ranging from 6 to 16 weeks in duration, the courses are designed to teach specialized characteristics of the PERSHING system to Army military and civilian instructors and supervisors already skilled in other missile systems. Instruction is given at the plant of The Martin Co., PERSHING prime contractor.

Col Charles J. Payne, Chief of the Army Ballistic Missile Agency Training Office, who is also training program director, said that 12 different specialty courses are offered.

Men selected to attend the courses represent a cross section of the Army elements which will have a part in the operation, maintenance and support of the PERSHING missile when it becomes operational.

The Martin plant has a classroom with a glass-paneled wall overlooking a special laboratory area. This permits students to watch as other trainees practice assembling, disassembling, repairing and checking out the missile system.

ABMA is the technical supervisor of the PERSHING program, now in advanced development.

$22,000,000 Contract Awarded For HAWK Missile Production

Six contracts totaling $49,952,104, largest of which is $22,000,000 for production of HAWK missiles, were awarded recently by the Army to the Raytheon Co., Waltham, Mass.

Production of HAWK ground support equipment is called for in a $13,000,000 contract. Work will be done in Andover, Waltham, and North Dighton, Mass.; Oxnard, Calif., and Bristol, Tenn. A $7,135,600 contract is for engineering services.

Other contracts are: $3,257,552 for electronic components for the HAWK missile system; $2,300,000 for HAWK field maintenance test shops; and $2,258,952 for engineering documents.

'Outmoded' Loki Darts Aiding High Altitude Studies

Steel darts 1½ inches in diameter and 40 inches long, originally designed for cluster firing in antiaircraft defense, have found a peaceful use at White Sands Missile Range as instruments of high altitude meteorological research.

Abandoned during the past decade in the swift pace of technology, the Loki darts, named for the character in Norse mythology who was known as the world's first dart thrower (no slight to Cupid intended), were driven by rocket boosters as high as 140,000 feet above WSMR.

Experiments involved bursting the darts at altitudes ranging from 10,000 to 140,000 feet to release light metallic confetti called chaff. Radar tracking of the chaff permitted calculation of wind speeds.

In this manner U.S. Army Signal Missile Support Agency rocket firing teams were able to record a profile of wind speeds for the area of the sky in which project engineers were interested.

Wind profile statistics were supplied to engineers launching the Project Banshee balloon for a high altitude explosion (See July issue, page 7).

Further use of findings facilitated tests of a high speed target, and information also was transmitted on the teletype circuits of the U.S. Weather Bureau meteorological network, and to the Atomic Energy Commission for an intensified study of nuclear fallout.

Eddleman Stresses Role Of Industrial Research

An "aggressive research program" in which American industry plays the major role holds the greatest promise for providing qualitative superiority of Armed Forces equipment, Army Vice Chief of Staff General Clyde D. Eddleman said at a recent meeting of the National Security Industrial Association.

General Eddleman reemphasized the close association and mutual dependence between the Army and American industry.

"The National Security Industrial Association has long been a valued link between American industry and the Armed Forces of our Nation. You provide us with a wealth of industrial ability, experience, and technological progress that is so vital to modern military forces," he told the group representing more than 600 industrial companies.

General Eddleman suggested a few examples where increased efforts in research and development cou'd pay large dividends for the Army: developing more effective means to attain strategic and tactical mobility; finding more efficient sources of power (to gain more versatility in combat and support and equipment); achieving significant reduction of bulk and weight in military logistics; designing improved nonnuclear weapons systems; and creating new materiel of all forms to conduct unconventional warfare and to counter indirect aggression.

Army Medics Study Possibility Of Joint Research With Peru

Special problems and opportunities related to collaborative medical research in Peru were studied by two Army officers during a 2-week trip to that country in October.

Col Ralph W. Bunn, Chief, Basic Research Branch, Life Sciences Division, Army Research Office, OCRD, and Lt Col Richard R. Taylor, Chief, Research Division, Medical Research and Development Command, Office of The Surgeon General, made the survey.

Dr. Pablo Mori-Chavez, Director of the Pathology Center of the Armed Forces Institute for Medical Research in Lima, Peru, expressed his interest in developing cooperative medical research during a recent visit to the United States.

Overland Train such as the above will take part in "Operation USAF Re-Supply," logistical resupply mission to Air Force outposts in Alaska. Designed as a mass transportation vehicle, the Overland Train rolls over snow and ice on 10-foot wheels, each powered by a separate electric motor.

Overland Train to Undergo Tests in Alaska

A portion of the Army's Overland Train will be evaluated for snow and extreme low temperature capabilities in "Operation USAF Resupply," scheduled to begin in Alaska in January.

The operation will consist of a logistical resupply mission to Air Force outposts at Bettles and Indian Mountain, Alaska.

Designed to serve as a mass transportation vehicle with an off-road capability not available in other Army vehicles, the Overland Train, when fully developed (completion date still indefinite), will consist of a lead car, 10 or more cargo cars and two power plants. Each of its 10-foot-diameter wheels is driven by an electric motor. (See January issue, page 10.) The unit under evaluation consists of only a power 'locomotive' and three load-bearing cars.

Three specially adapted escort vehicles which will take part in the Alaska mission left Fort Eustis, Va., in October for a 30-day, 5,000-mile overland trip to Fort Wainwright, near Fairbanks in northern Alaska.

These included a "camper" mounted on a modified FC-170 1½-ton cargo carrier, a command car and a fully equipped maintenance "shop," also mounted on an FC-170 cargo carrier.

Insulated against extreme cold, the camper vehicle will provide eating, sleeping and sanitary facilities for six men. This will be the first Army use of such facilities in convoy operations. The camper vehicle is capable of two-way radio contact with the vehicles of the convoy and radio stations of their Alaskan base.

The command car, a modified jeep station wagon, is equipped with oversize heaters, a two-way radio, special warning lights and other facilities for its long journey.

GIMRADA Civilians Present Papers on Mapping Technology

Bela J. Bodnar presented a technical paper on "Flash Triangulation as a Practical Geodetic Tool" at the Third United Nations Regional Cartographic Conference for Asia and the Far East in Bangkok, Thailand.

Two of Mr. Bodnar's coworkers at the Geodesy, Intelligence and Mapping Research and Development Agency, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., also delivered papers at recent conferences.

Edward R. DeMeter addressed the semiannual meeting of the American Society of Photogrammetry in New York City on "Automatic Point Identification, a Marking and Measuring Instrument." John G. Collins wrote a paper delivered to the same group on "Interim Halcon Stereomapping System."

Mr. Bodnar said a study showed that a proposed flash triangulation system was an economical and efficient method capable of providing accuracy equivalent to that of first order triangulation. Its main application, he said, would be in extendng mapping control and in general survey work, especially in island ties.

Mr. DeMeter said, "The automatic point identification, a marking and measuring instrument, is an integrated system for the selection, identification, marking and measurement of pass points and control points. The primary use intended is for control extension by analytical triangulation."

Mr. Collins listed improvements in a Halcon stereomapping system which, if they were achieved would provide accuracy sufficient for drawing 20-foot contours from photos taken from 100,000 feet altitude.

Management Experts Address AFMA Parley

Top defense officials, educators and industrialists addressed the Eighth National Conference of the Armed Forces Management Association in Chicago, Oct. 25-26.

Among the speakers were: AFMA President Thomas D. Morris, Assistant Secretary of Defense for Installations and Logistics; Paul A. Ignatius, Assistant Secretary of the Army for I&L; and Hugh McCullough, Deputy Assistant Secretary of Defense Programming.

"Good Management Is Everybody's Business" was the theme of presentations pointed toward all levels of management in defense and industry. Management of material procurement and logistics programming highlighted the seminars and displays of the conference.

Mr. McCullough presented the new "program package budget" concept and Don Malcolm of Operations Research, Inc., exhibited live demonstrations of a "PERT Management Game."

Lt Gen Emerson L. Cummings, USA, Commanding General, Fifth U.S. Army, opened the conference with a welcoming address. Mr. Morris presented the AFMA National Awards at the National Awards Banquet and Robert R. Gros, Vice President, Pacific Gas & Electric Co., was the guest speaker.

Vice Adm O. S. Colclough, USN, (Ret.), The Provost, George Washington University, was moderator of the Educational Program Session, and Norman Cottrell of Remington Rand-Univac, moderated the Industry Program Session.

Top educators from the Nation's leading colleges participated in Admiral Colclough's Educational Program Session. Participating with Mr. Cottrell in the Industry Program Session were: Dr. C. R. DeCarlo, Director of Education, International Business Machines Corp.; Donald G. Malcolm, Vice President, Operations Research Inc.; M. O. Kappler, President, System Development Corp.; Rear Adm G. T. Mundorff, USN, (Ret.), and Dr. William Bloom, General Precision, Inc.

Services Unite in Funding VTOL Test Aircraft

Development and fabrication of an experimental tilt-wing VTOL transport aircraft will be financed jointly by the Army, Navy and Air Force.

Each of the services, by a recent agreement, has contributed $7 million for FY 1961 and FY 1962, and will share the remainder of the costs. The entire program may cost over $70 million, which would cover the fabrication of five transport aircraft.

The transports will be capable of taking off and landing vertically, cruising at 250 to 300 knots an hour, and will have a radius of action of 200 to 300 nautical miles with up to 8,000 pounds payload.

Prototype development is intended to meet the needs of the Air Force and the Army, and have the capability of meeting the Navy's requirements in the future.

Under consideration by the three services is a supplementary research program to evaluate more advanced concepts of VTOL aircraft based upon designs submitted. If one or more additional configurations is selected for further development, cost of the total program may exceed $100 million.

PERSHING Scores Success On Target 200 Miles Away

A PERSHING artillery missile undergoing test at Cape Canaveral recently hit a target nearly 200 miles away.

The feat was another in a string of successful firings which confirmed, Army sources said, the high reliability expected of this advanced missile system. The firing record established by PERSHING at the Atlantic Missile Range was said to exceed that attained by any other U.S. large missile system.

The first stage of the 34-foot missile fell away about 40 seconds after the launching and said these included further evaluation of the guidance and control equipment, missile structure and performance of warhead components.

Announcing that the Martin-made PERSHING achieved all test objectives, the Army the second stage fired almost instantly. A series of flares attached to the nose cone enabled powerful cameras down range to track the missile optically.

White Sands Civilians Author Papers for IRE Publication

Three civilian employees of White Sands Missile Range, N. Mex., are authors of technical papers included in the October special issue of a publication of the Institute of Radio Engineers sponsored by the Professional Group on Military Electronics.

The authors, all with the Range Instrumentation Development Division of the Integrated Range Mission, and titles of their papers are:

- William E. Mimmack, physicist, Optical Systems Branch, "Information Bandwidth Problems in Instrumentation of Missile Flight Tests."
- Robert A. Voss, electronic engineer, Electronic Trajectory Systems Branch, "The Design of a CW Passive Missile Trajectory Measuring System."
- Gus F. Bigelow, electronic engineer, Telemetry Systems Branch, "Microwave Telemetry at U.S. Missile Ranges." Coauthors of the last-named papers are T. B. Jackson of the Naval Ordnance Laboratory, Corona, Calif., and R. T. Merriam, Naval Ordnance Test Station, China Lake, Calif.

The special issue is devoted entirely to "Missile and Space Range Instrumentation."

ERDL Award Initiated For Science Achievement

Establishment of an annual award for scientific achievement at the U.S. Army Engineering Research and Development Laboratories, Fort Belvoir, Va., has been announced.

All personnel of the Laboratories in nonsupervisory technical positions rated at GS-13 or below are eligible for the award to be made by the ERDL Branch of the Scientific Research Society of America (RESA).

Basis of the award is achievement in pure and applied sciences. Emphasis is on individual scientific accomplishment as distinguished from direction or leadership of a group. The winner will receive a certificate and a technical book or books of the recipient's choice, not to exceed $25 in value.

Objective of the new award is to encourage personnel at the junior and intermediate levels who are engaged in original investigation in pure and applied science to strive for greater accomplishments.

Work for the initial award must have been completed within the period of 1957 through 1961, as determined by the Grants and Awards Committee of the ERDL Branch of the RESA. Results must be supported by publication of articles in scientific journals, ERDL reports and patents, or by unpublished papers presented at scientific meetings.

The Committee comprises Vincent J. Bagdon, employee of the Materials Branch, Chairman; Dr. Z. V. Harvalik, Director, Basic Research Group; Donald P. Easter, Basic Research Group; Theodoric B. Edwards, Civil Department; and Howard G. Lasser, Materials Branch.

Watervliet Scientists Present Papers at International Parley

Watervliet Arsenal scientists presented two papers at the First International Congress on Experimental Mechanics, Nov. 1-3, New York City.

Dr. R. E. Weigle, Chief of the Research Branch, and John J. Purtell, who heads the experimental mechanics laboratory, discussed their work on the mechanics of materials in "A Process Technique for Determining Residual Stresses in Circular Tubes."

The basic nature of "autofrettage," which imparts greater strength to gun tubes through the use of extreme hydrostatic pressures, was described in "The Overstrain of High-strength Open-end Cylinders of Intermediate Diameter Ratio." This paper was prepared by Thomas E. Davidson, Chief of the Arsenal's metal working section, Industrial Processes Branch, project engineers Albert N. Reiner and David P. Kendall, and C. S. Barton, an Arsenal consultant.

ERDL Testing Night Harborless Tanker Unloading

Technicians from the Army Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va., are testing procedures and equipment that will enable giant tankers to move into offshore positions under protection of darkness, unload their cargoes without aid of harbor facilities, and depart before daybreak.

Tests are being conducted in Block Island Sound, off Fishers Island, New York, to develop means whereby large tankers can participate directly in military operations and speed up wartime supply of petroleum to fighting forces.

Specially designed pipelines have been laid from the shore to mooring positions in open water more than a mile from shore. Tests include placing of submarine pipelines by both onshore and offshore pulling operations.

Essence of the technique is the speed in constructing the pipelines and in unloading the ships so that large vessels will not be targets for enemy attack in daylight.

Perfecting means of unloading military tankers in 8 to 10 hours without the aid of port facilities is the main objective. Normally 12 to 15 hours are required to unload a regular commercial tanker, safely tied up in port, plus additional time to enter and leave the port. Methods being used in the tests have been adapted from commercial offshore unloading techniques now employed for giant tankers too large to enter port with full cargo.

Under test also are specialized equipment and methods for installing and anchoring the tanker mooring legs, and a new type of collapsible unloading hose.

Periodic 'Physicals' Keep CmlC Lab Machines 'Well'

Recognition that machines require periodic "physical checkups," just as their operators, is behind the preventive maintenance program at the U.S. Army Chemical Corps' Biological Laboratories, Fort Detrick, Md.

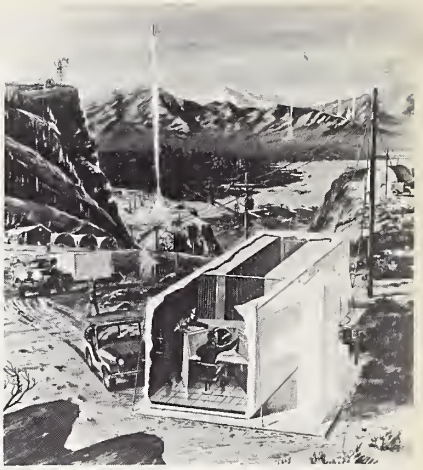
The new system is intended to prevent breakdown of vital machines and equipment during crucial R&D testing.

Backbone of the system is a basic manual in which every type of maintenance work is described step by step and catalogued. Each item needing periodic maintenance, 20,000 in all, is inventoried on an electronic computer card. The cards contain various amounts of pertinent information in simple form.

Fed through electronic equipment at scheduled intervals, the cards list equipment, location, reference number in the maintenance manual, amount of time needed to work on it, and the department to be billed for the work.

Initiated after a 2-year study of maintenance problems by the post Technical Engineering Division, the system provides an orderly method of maintaining machinery, equipment and real property in efficient, continuous operation. Cards are selected two to three weeks ahead of schedule, affording additional time to plan the best utilization of workers.

Important results produced in the first year are improved methods of determining in advance a significant portion of the total maintenance workload; estimating maintenance costs for fiscal budgeting; keeping necessary materials available when needed; scheduling the workload of maintenance forces to the best advantage; and prescribing safety practices where special industrial or biological hazards must be met.



Artist's conception of BIRDIE air defense coordination system in action as described in October issue, page 4, a report on installation of the first of 19 BIRDIE ("Midget Missile Master") systems at Turner Air Force Base, Ga. BIRDIE, developed by the U.S. Army Signal Corps, complements Missile Master network for key major cities.

Rocket Weapons Used by Both Sides in Civil War

Army missile men at Redstone Arsenal, Ala., have found to their surprise that during the Civil War the Yanks and Rebs actually fired rockets at one another—similar in certain respects to some of the smaller weapons developed in recent years at Redstone.

Of course there were basic differences, the missile engineers are quick to point out. Although the search for simplicity goes on constantly, the modern Army has yet to come up with a rocket that can be fired from a water trough propped up on a stump.

That's the way some of the Civil War rockets were launched.

The Civil War rockets came to light while the Army Ordnance Missile Command was searching for interesting public exhibits to be displayed at the Alabama State Fair in Birmingham.

Chasing a lead, the Army missile men began writing letters. One to the United States Military Academy at West Point, N.Y., paid off. West Point had not only heard of the Civil War projectiles; five of the recovered rockets are on display in the museum there.

Another authority on the Army in the Civil War said a fellow named Hale, an Englishman, designed the "war rockets" used by the Union Army. Most of Hale's rockets were a little over 2 feet long, about 3½ inches in diameter, with a steel nose cone and a flared exhaust nozzle.

A mixture of gun powder served as a rocket motor for some of the old timers. Holes drilled in the rocket allowed escaping gasses to spin the rockets about their longitudinal axis to stabilize them in flight. The Army still uses spin stabilization in several of its operational rockets.

Hale's devices were single-stage rockets. (A report that 2 stage rockets existed during the Civil War could not be confirmed by the U.S. Army Research Office at Durham, N.C.) They had a range of over a mile, depending on the launch angle and the amount of gunpowder used for propellant.

Clement Eaton said in a book on the *History of the Southern Confederacy* that the North invented a number of rockets, conducted experiments and demonstrations. He said both sides used rockets as signal devices. The Confederates employed signal rockets of different colors at night.

Unlike the sleek weapons of today, the Civil War rockets resembled something turned out by an enthusiastic but untalented blacksmith. Their nose cones were cast iron, plugged with wood and riveted to the body. The engine was sheet metal bent into a cylindrical form and corrugated for strength. A cast iron ring went into the tail section and the exhaust nozzle was screwed into the ring.

The whole thing was covered with canvas (to be removed before firing, an Army manual pointed out). Launchers were made of sheet iron with wrought iron legs to vary the launch angle and adjust the range. The rockets weighed from 6 to 16 pounds loaded.

Perhaps most significant was the statement appended to one contemporary description of the rockets: "Range and deviation of rockets vary considerably."

Provocative Ponderables

In a recent speech to the Civic and Defense Industry Representatives titled "Research and Development: Aladdin's Lamp," Lt Gen Arthur G. Trudeau, Chief of Research and Development, discussed the Communist threat to the Free World and closed with the following:

The keys to our survival are faith, not fear; courage, not complacency; and patriotism, not patronage.

Our President has laid down the guidelines and people have certainly responded magnificently to his support these last few months. We need his kind of leadership; he needs this kind of support. To maintain it to meet the challenge that lies ahead, we need a strong, moral adrenalin. Brinkmanship is always a hazard—but brinkmanship arises because there is a hazard. Still, I am not as afraid of *brinkmanship* as I am of what may be called *shrinkmanship* — the tendency to shrink from the duty to stand up to the things which we know are right.

Listen to the advice Rudyard Kipling—that sage English poet—gives us in this prescient poem — words which — I daresay — have greater meaning today than when they were written almost half a century ago:

Nations have passed away and left no traces,
And history gives the naked cause of it—
One simple, simple reason in all cases;
They fell because their people were not fit. . .
There is one lesson at all Times and Places—
One changeless Truth on all Things changing writ,
For boys and girls, men, women, nations, races—
Be fit—be fit! And once again, be fit!

WSMR Vigilance Avoids Missile Mishaps

When a modified German V-2 missile made an unpredicted 180° turn at the White Sands Missile Range, N. Mex., in May 1947, officials in charge wiped away their sweat and decided, then and there, that a safety device was needed to control errant missiles.

Fortunately no casualties resulted from this incident and now, 14 years later, WSMR boasts an outstanding safety record.

George H. Ross, Deputy Chief of the Range's Missile Flight Surveillance Office (MFSO), heads a group of 22 trained employees and is understandably proud of the near-perfect safety record there. Thousands of missiles—Army, Navy and Air Force—have been launched from the 4,000-square-mile range since its beginning in 1945, with no death, injury or appreciable property damage attributable directly to flight tests.

After the V-2 incident, New Mexico State University (then New Mexico A&M) was employed to provide and operate a safety system independently but under the guidance of WSMR personnel. The primary objective was to prevent missiles from overleaping the WSMR test area.

With stepped-up test programs increased from some 1,250 "hot" firings in 1955 to an average of more than 2,000 a year, WSMR's safety engineers now have to be even more on the alert.

These engineers are handpicked experts who keep an eye out for misbehaving missiles, and make no compromise with safety in carrying out possibly the "touchiest" job at the desert installation.

Statistics of Missile Flight Surveillance reveal that today's supersonic weapons are relatively safe. Records show that the safety-conscious men who follow the missile's flight progress do not hesitate to flick the red switch that blows thousands of dollars worth of hardware into fragments should the action be necessary for safety.

An MFSO man keeps safety surveillance at a plotting board which charts the missile's flight in relation to range boundaries. Radars tracking the missile feed back data converted onto the automatic plotting board by special computers. The board is covered with a grid—scaled map of the range with "safe area" clearly marked—and has a pen that traces movements of the missile from launch to impact.

For ground-to-air missiles, one pen tracks the movements of the missile while another pen at the opposite end of the plotting board follows the flight pattern of the drone target. When the two pen tracks meet, a hit is indicated.

If the pen tracing the missile's flight-path shows that the bird is getting outside of the safe area, the MFSO officer snaps the switch which touches off the safety device inside the missile, thereby terminating its flight.

Information from the plotting board, along with data from other instruments, enables MFSO personnel to determine not only the necessity for a destruct or recovery action, but also the exact instant at which such action will be completely safe.

Any missile capable of leaving the vast range must be equipped with some type of flight safety system. This may be a built-in part of the system itself, a specially built part installed prior to delivery to WSMR, or a "safety package" provided by MFSO. However, certain types of missiles do not need safety devices because, much like an artillery shell, once launched they follow a trajectory subject only to the natural laws of physics.

Every missile launched from WSMR must satisfy the safety requirements of MFSO and, when applicable, contain a safety mechanism. MFSO safety engineers also must meet exacting requirements. Sometimes a man has as little as 25 seconds to decide whether or not to cut down a missile in flight.

Nathan Wagner is Chief of MFSO. In addition to Ross, other supervisory personnel include W. C. Meeks, Chief of Plans and Operations; Merrill E. Smith, Chief of Technical Support; Paul K. Arthur, Chief of Field Engineering, and Beryl M. Brunton, Chief of the MFSO Laboratory.

Retiring Chemical Engineer Wins High Decoration

Dr. L. Wilson Greene, Chief Technical Adviser of the U.S. Army Chemical Research and Development Laboratories, Army Chemical Center, Md., retired recently to end a distinguished 32-year career in Government service.

In recognition of his outstanding accomplishments he was awarded the Department of the Army Decoration for Meritorious Civilian Service on his last day on the job. The accompanying citation paid tribute to him as a pioneer in psychochemicals.

Starting with the Army Chemical Corps in 1929 as an engineer, Dr. Greene became influential in designing and putting into operation the production plants involved in the pre-World War II expansion of facilities at the Army Chemical Center. In 1941 he went to Huntsville, Ala., to supervise the chemical engineering required to establish the $75 million Chmical Corps arsenal.

When he entered the Army in 1942, he remained at Huntsville as Chief of the Operations Division until 1945, then was assigned to Germany as Chief of the Chemical Industries Section, Military Government, U.S. Zone.

After the war he supervised the chemical disarmament program and decentralization of the German chemical industry, then returned to the Army Chemical Center as a civilian and was appointed Chief Technical Adviser of CRDL when it was formed in 1956.

Brig Gen Fred J. Delmore, Commanding General of the Chemical Corps Research and Development Command, bids adieu to Dr. L. Wilson Greene.

AOMC Leader Discusses Missiles Operations

By Maj Gen August Schomburg

Army missiles are a lot like parachutes—you may never need them but when you do, you really need them.

Our job at the U.S. Army Ordnance Missile Command boils down to about this: If a soldier needs a missile, its our responsibility to see that it's there, it's ready, and it works.

Like the parachute makers, we get no second chance. If our missiles don't work right the first time they're really needed, someone is going to get hurt. It could be a single soldier facing a tank, it could be you or your wife and children facing an intercontinental ballistic missile.

The responsibility to arm the Army with missiles is ours. We cannot delegate it. We can and do turn to American industry for the know-how, the technological achievement, the production genius. It's a partnership well founded in mutual respect.

The 18,000 men and women of AOMC are scattered over much of the earth, wherever there are Army missiles. Most of them can be found at Redstone Arsenal, Ala., our home. Many more are at White Sands Missile Range, N. Mex., our primary testing site. Others are in Europe, on Ascension Island in the South Atlantic, Fort Churchill in the Arctic, Kwajalein Island far out in the Pacific.

The Command's responsibility is a birth-to-grave concept. Our scientists and technicians start with a weapon system when it is a dreambook item. After its feasibility is proved, they stick with it through design, research and development.

Our objective is to give the United States Army the newest, best, simplest, most rugged and most reliable weapons possible in the shortest possible time.

Along with our other objectives we must ever keep in mind the Nation's economy and the American taxpayer. We must guarantee a maximum of value for every defense dollar we are charged with spending.

For many years the Army Ordnance Corps has relied upon American industry to turn out Ordnance items required for Army military missions. AOMC is a strong supporter of this policy and calls upon the industrial potential of America for maximum help in fielding Army missile systems.

However, it is still our responsibility to see that the job gets done—that the weapon fills the need. To do this we feel it is necessary to keep ourselves knowledgeable in order to insure that our procurement package outlines a feasible end item for industry to produce.

We must be able to give the necessary guidance in effecting early completion of a desired weapon. Our scientists and technicians must do enough of the actual "dirty" work to keep their hands as well as their brains active.

Each missile program teaches us something. The valuable experience accumulated in all development programs is essential. So much time can be saved by applying knowledge gained in one program to a more advanced one.

Contractors change from system to system and we must be the depository of knowledge in the science of weaponry. It is the task of our industrial partners to translate our hard-won knowledge into the actual hardware.

In fulfilling our role of leadership we make full use of the "in-house" capabilities of the Command's two commodity agencies—the Army Ballistic Missile Agency and the Army Rocket and Guided Missile Agency. We also use facilities and personnel available at other Ordnance installations and Technical Services.

Some of our missile systems have ranges of a few hundred yards, others hundreds of miles. Some are surface-to-surface missiles with ballistic trajectories. Others are surface-to-air, using command guidance.

Some are small, one-soldier rockets. Others have more complex missions and require a multiplicity of launch and guidance equipment. The number of missile systems involved and their diversity make our management job a complex one.

Army missile business is big business. Our annual level of effort is approximately $1.5 billion which ranks us 21st in the Nation in comparison with such industrials as General Motors, U.S. Steel, Chrysler and Du Pont.

American industry gets about 90 percent of the money appropriated to AOMC. At last count more than 54,000 businesses shared in our contracts.

Overall weapon system management is the assigned responsibility of the Commanding General of AOMC. Command Headquarters manages the whole Army missile system program, maintaining priorities established by higher authority. It coordinates the performance of work on the various systems within these established priorities. It is from here that the weapon system manager controls the performance in each system to insure that schedules will be met.

Headquarters also coordinates the general contributions of the agencies of AOMC, other Ordnance activities, and contributing Army agencies. Its general staff type organization is modified somewhat to meet special needs of the missile business. For instance, an Assistant Chief of Staff for Military Applications and Training has been established to maintain continuing contact with the user to insure that weapons will be compatible with the needs of troops.

Another modification is the employment of offices representing Technical Services which contribute to missile development. These are not liaison offices, but full-fledged members of the missile team.

We exercise technical supervision over individual programs through ABMA and ARGMA, both agencies being located at Redstone Arsenal. ABMA is responsible for those missile systems whose trajectories are predetermined, essentially ballistic in nature. ARGMA is responsible for those systems requiring maneuverable and controllable capabilities. This includes both surface-to-surface and surface-to-air systems.

This distribution of missions was not arbitrarily determined, but based essentially upon technical considerations, especially in terms of cross-fertilization among systems utilizing similar guidance and control techniques, and the avoidance of duplication in laboratory facilities.

The organization of both ABMA and ARGMA follows this pattern:

- The supervision of our system effort is accomplished through a functional organization consisting of Research and Development, Industrial, and Field Support.

- The Agency Commander has the job of directing and coordinating the activities of these functional areas for the weapons systems that he has been assigned. He facilitates the coordination of these projects by utilizing project officers. Each project officer is assigned the job of coordinating the activities of a particular functional area as it pertains to his assigned project.

Separating logistical support responsibility from the people responsible for developing weapons systems is included in the AOMC management concept. This service for all units located at Redstone Arsenal is performed by Army Ordnance Missile Support Agency.

AOMSA also performs functions common to the development agencies which need not be under the direct control of either agency, as well as certain national support missions.

In order to provide the most advanced weapon to field troops in a time frame when it may be expected to combat effectively a predicted threat, we must telescope the various phases of missile development leading to deployment. This part of our management concept decreases the time from design to deployment and overlaps research and development, production, training, support and deployment.

This is a general picture of AOMC . . . its mission . . . its scope . . . its organization. Our job is managing Army missile development and our management concepts must be as progressive as our products.

Nobel Winner Addresses Organic Chemistry Group

Nobel prize winner Dr. Artturi I. Virtanen, President, The Finnish Academy of Art and Sciences, Helsinki, Finland, made the principal address at the Fifth Organic Chemistry Conference in mid-October at the Quartermaster Research & Engineering Command, Natick, Mass. His subject was "Organic Sulfur Compounds in Vegetables and Their Importance in Human Nutrition."

Sponsored annually by the National Academy of Sciences-National Research Council, Advisory Board on Quartermaster Research & Development, Committee on Pioneering Research, the conference is on an invitational basis.

Dr. Torsten Hasselstrom, head of the Organic Chemistry Laboratory, Pioneering Research Division, Quartermaster Research & Engineering Center, was chairman and Dr. Louis Long, Jr., of the Organic Chemistry Laboratory, was moderator at the Natick parley.

Other speakers included Dr. D. G. Doherty of Oak Ridge National Laboratory, Dr. B. R. Baker of the University of Buffalo, Dr. F. G. Bordwell of Northwestern University, Dr. M. Carmack of Indiana University, Dr. I. B. Douglass of the University of Maine, Dr. N. Kharasch of the University of Southern California, and Dr. D. S. Tarbell of the University of Rochester. All are noted specialists in organic chemistry. Dr. Arne Fredga of Uppsala, Sweden, organo-sulfur chemist, was among the distinguished guests.

Top Leaders Cite Army R&D Benefiting Civilians

A radio the size of a fountain pen, a pill that causes the body to throw off an odor repellant to insects, and instant meals that require only the addition of hot water to be ready for eating are a few of the items under development by the Army which may be available to civilians within a few years.

These developments and others were disclosed recently at the Long Island Fair and Science Exposition in Westbury, N.Y., by a panel of high ranking officers. They explained how Army research in areas such as electronics, chemistry, medicine, aviation, meteorology, and transportation will continue to benefit the civilian population as well as soldiers.

Maj Gen William D. Hamlin, Commanding General, U.S. Army Signal Training Command, said that tiny electronic micromodules, only 1/10 the size of the most advanced present-day miniaturized circuits, are expected to reduce considerably the size of radios and television sets of the future.

"I have seen research models of high quality radio receivers as small as fountain pens," he said.

Brig Gen Merrill L. Tribe, Commanding General, QM Research and Engineering Command, said the Army's QM Corps is developing a complete dehydrated meal, ready to mix with hot water and then be eaten. Under study is a method to preserve perishable food without refrigeration.

The oral insect repellant is under development by the Medical Corps. Swallow the pill, said Col Colin Vorder Bruegge, Deputy Commander, U.S. Army Medical and Research Command, and your body will give off an odor that is reported to be repellant only to insects.

Discussed by the panel were features of a new turbine-powered helicopter that may make economically practical wide use of such craft by small business and industry; nitrogen mustard treatment of cancer; development of plastic arteries to replace torn blood vessels; improved weather forecasting methods, materials handling techniques, new molded plastics and rain repellents.

The panel was assembled for a special meeting of the Aviation/Space Writers' Association and held in conjunction with the Annual Convention of the National Aeronautics Association. Brig Gen Clifton Von Kann, Director of Army Aviation, was the moderator.

Other panel members were Maj Gen William K. Ghormley, Commanding General, U.S. Army Special Weapons Command; Brig Gen Thomas H. Lipscomb, Division Engineer, U.S. Army North Atlantic Division; Brig Gen Charles F. Tank, Commanding General, U.S. Army Transportation Terminal Command, Atlantic; and Lt Col Richard M. Clendenin, Scientific Information and Liaison Division.

ERDL Veteran Named Chief Of Mechanical Department

Mark H. Henderson has been appointed Chief of the Mechanical Department at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

The Mechanical Department is concerned primarily with the research, design, development and testing of material and equipment in the fields of construction, maintenance, industrial gases and industrial engines.

Mr. Henderson has been a Civil Service employee since 1940.

Col John J. Hayes is the newly assigned Deputy Commander of the U.S. Army Chemical Corps Research and Development Command, Washington, D.C. He succeeds Col John A. Martin who retired from the Army after 20 years of service. Col Hayes came to his new post from Headquarters, U.S. Army, Europe, where he had served as Chemical Officer since August 1959.

DOD Makes Posthumous Award to DSB Scientist

Dr. Howard P. Robertson, first permanent chairman of the Defense Science Board (DSB), has been awarded posthumously the Department of Defense Medal for Distinguished Public Service by Secretary of Defense Robert S. McNamara.

Deputy Secretary of Defense Roswell L. Gilpatric presented the medal to Mrs. Howard P. Robertson.

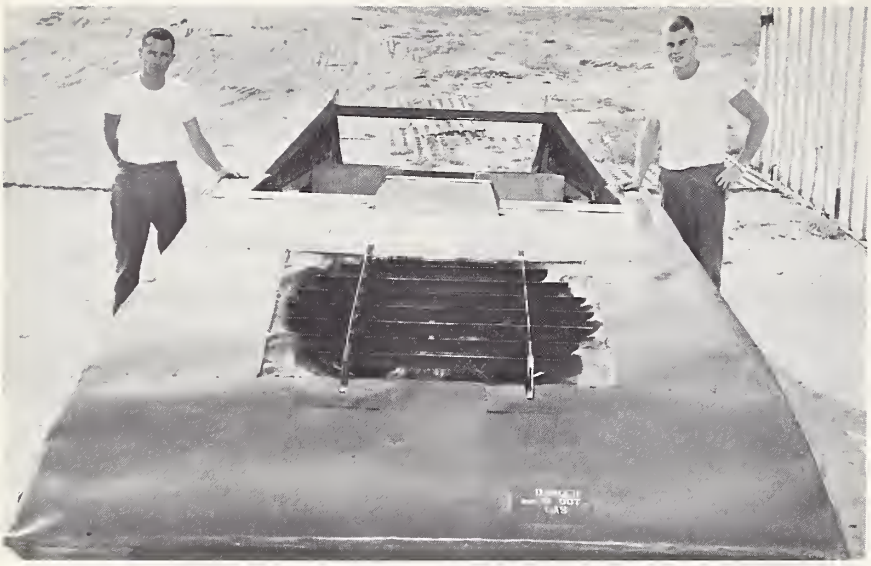
In attendance at the ceremony were members of the Defense Science Board including Chairman, Clifford Furnas and Dr. Hugh L. Dryden. Others who attended were: Dr. Harold Brown, Director, Defense Research and Engineering; John H. Rubel, Assistant Secretary for Defense (Research and Engineering); and Dr. Theodore von Karman, Chairman of the Long-Range NATO Scientific Study Group and one of the world's top scientists.

Dr. Robertson, 58, had been chairman of the DSB for more than five years when he died Aug. 26 as a result of injuries incurred in an automobile accident. He was to have been presented the medal at a dinner scheduled for October.

A noted cosmologist, Dr. Robertson was a member of the National Academy of Sciences and a Professor of Mathematical Physics at the California Institute of Technology. Under his leadership DSB emerged as an important force in assisting the Secretary of Defense and the Director of Defense Research and Engineering.

His citation reads:

"For exceptionally meritorious civilian service as the first permanent chairman of the Defense Science Board. At great personal sacrifice, he brought outstanding scientific competence, administrative insight and rare judgment to bear on a multitude of problems. Through exercise of his wise counsel, the Defense Science Board has emerged as the primary advisory group for research, development, test and evaluation serving the Director of Defense Research and Engineering and the Secretary of Defense. His imaginative and constructive approach, and his broad knowledge of scientific programs and weapons systems have materially contributed to the effectiveness of the Department of Defense both within the United States and the Free World."



Model GEM designed and built by Peter Stone, left, and B. K. Johnson.

TRECOM Ships GEM to Student Builders

Engrossed again in their studies at Dartmouth University, two young men intent on scientific careers are continuing GEM (ground effects machines) research started as trainee employees this past summer at the U.S. Army Transportation Research Command, Fort Eustis, Va.

Bruce K. Johnson, West Lebanon, N.H., and Peter Stone, West Hartford, Conn., were employed as trainees on a recommendation of the Army Research Office-Durham. As part of a course requirement at Dartmouth, they designed and engineered a model GEM.

A full-size prototype vehicle they built while utilizing facilities at Fort Eustis is constructed of aluminum and fiberglass and powered by a 45 hp. Nelson engine. The test bed is 8 feet wide, 16 feet long, 3 feet high and weighs 500 pounds.

The vehicle is designed to travel about six inches above the surface of ground or water on a cushion of air. A 4-bladed, variable pitch ducted fan provides the air for lift, propulsion and directional guidance. Because of its light construction the GEM is capable of floating while at rest in water.

William E. Sickles, Chief, Engineering Sciences Division, USATRECOM, said the vehicle shipped to Dartmouth permits Johnson and Stone to continue their experimental program, incorporating it as part of their graduate studies. Results are expected to provide needed dynamic performance data for the GEM research program.

M-14 Rifle Contracts Awarded To New Supplier in Cleveland

Contracts totaling $15,076,234 for production of the new lightweight M-14 rifle were awarded in October by the Department of the Army to Thompson - Ramo - Woolridge, Inc., Cleveland, Ohio.

An $8,554,070 contract is for 100,000 M-14 rifles and the other is a $6,522,164 contract for rehabilitation of existing facilities and purchase of production equipment. Initial deliveries of the rifle are scheduled in November 1962.

The M-14 rifle is capable of both automatic and semiautomatic fire and fires the standard NATO 7.62 mm. cartridge. It replaces four hand weapons currently in use by the Army. This weapon, along with the new M-60 light machinegun, is now being issued to Army field troops.

$16 Million in Contracts Let for Air Defense Missiles

Contracts totaling $16,065,000 for work on its MAULER, NIKE AJAX, and NIKE HERCULES air defense missile systems were announced recently by the Department of the Army.

A $13 million contract went to General Dynamics Corp., Pomona, Calif., for continued development of the MAULER, a highly mobile air defense weapon designed to destroy high-performance tactical aircraft and short range missiles and rockets on the battlefield.

Another contract, for $1,565,000 to Western Electric Co., calls for continued production of components for the NIKE HERCULES missile system. Work is to be done at the company's Greensboro and Winston Salem, N.C., plants.

Work on a $1.5 million contract for engineering documentation on the NIKE AJAX and NIKE HERCULES systems is to be performed at the Western Electric Co., Winston Salem plant. General Electric at Syracuse, N.Y., and Douglas Aircraft Co. of Santa Monica, Calif., will share in the award.

NIKE AJAX and NIKE HERCULES are operational air defense weapons defending key cities and defense installations against attack by aircraft, and are forerunners of the NIKE ZEUS, the Army's anti-missile-missile system now in advanced development.

The U.S. Army Rocket and Guided Missile Agency at Redstone Arsenal, Ala., is the technical supervisor for these missile programs.

Scientific Calendar

1961 Fall Meeting of International Congress on Experimental Mechanics, N.Y.C., Nov. 1-3.

Clinical Symposium on Cancer Chemotherapy, Washington, D.C., Nov. 2-3.

Mathematical Models in the Social & Behavioral Sciences, Cambria, Calif., Nov. 2-5.

International Meeting of Society of Exploration Geophysicists, Denver, Nov. 5-9.

Non-Linear Magnetics Conference, sponsored by AIEE and IRE, Los Angeles, Nov. 6-8.

1st Annual Symposium on Cell in Mitosis, Detroit, Nov. 6-8.

Atomic Industrial Forum—9th Hot Laboratories & Equipment Conference, Chicago, Nov. 6-8.

7th Conference on Radio Interference Reduction & Electronic Compatibility, Chicago, Nov. 7-9.

3rd Meeting of Joint Army-Navy-AF-NASA-ARPA Liquid Propellant Group, Miami, Nov. 7-9.

1st Joint National Meeting, sponsored by Operations Research Society of America & The Institute of Management Sciences, San Francisco, Nov. 8-10.

Conference On Nondestructive Testing In Electrical Engineering, London, England, Nov. 8-10.

Annual Meeting of Division of Plasma Physics, sponsored by American Physical Society, Colorado Springs, Nov. 8-11.

Joint Meeting of Operations Research Society & Institute of Management Sciences, Philadelphia, Nov. 8-11.

4th Conference of Applied Meteorology, sponsored by American Meteorological Society, Nov. 8-11.

Bahamas Conference on Medical & Biological Problems in Space Flight, Nassau, Bahamas, Nov. 12-17.

7th Annual Conference on Magnetism & Magnetic Materials, Phoenix, Ariz., Nov. 13-16.

Mid-Atlantic Electronic Conference, sponsored by IRE, Washington, D.C., Nov. 14-16.

2nd International Conference on the Exploding Wire Phenomena, sponsored by Thermal Radiation Laboratory, Boston, Nov. 14-16.

1961 Electron Devices Meeting, sponsored by IRE, Washington, D.C., Nov. 20-21.

Conference on Radioisotopes in Animal Biology & the Medical Sciences, Mexico City, Nov. 22-Dec. 1.

28th Exposition of the Chemical Industries, N.Y.C., Nov. 27-Dec. 1.

Conference on Vehicular Communications, sponsored by IRE, Minneapolis, Nov. 30-Dec. 1.

Annual Meeting of American Institute of Chemical Engineers, N.Y.C., Dec. 3-7.

Eastern Joint Computer Conference, Washington, D.C., Dec. 12-14.

2nd Latin American Congress of Microbiology, San Jose, Costa Rica, Dec. 10-17.

121st Annual Meeting, sponsored by American Statistical Association with Institute of Mathematical Statistics, N.Y.C., Dec. 27-30.

High Officials Address ERDL Reserves on R&D

Active duty for 35 members of Mobilization Detachment No. 39, Army Reserve unit at the U.S. Army Engineer Research and Development laboratories, Fort Belvoir, Va., consisted of a 2-week "Military Research and Development Conference" at nearby Fort Myer, Va.

Given an opportunity to get away from laboratory projects for an objective overall look at Army R&D, as outlined by top level officials, the group toured ERDL facilities, the U.S. Naval Air Test Center at Patuxent River, Md., and the Munitions Building in Washington, D.C.

Brig Gen William F. Ryan, Director of Plans and Management, Office of the Chief of Research and Development, Department of the Army, was a featured speaker on the subject of R&D planning and management.

Among other speakers were: Dr. Richard A. Weiss, Deputy and Scientific Director, Army Research Office (ARO); Dr. John T. Holloway, Office, Director of Science, Director of Defense Research and Engineering; Col George W. Howard, Commander of Detachment No. 39 and Technical Director of ERDL; and Lt Col Frank L. Schaf, Chief, Technical Forecasting Branch, Research Planning Division, ARO.

Research subjects discussed were requirements, planning, accomplishment, and utilization. Development topics included requirements, planning, accomplishment, standardization and quantity procurement.

25 Scientists Escape Swift Shift of Arctic Weather

Dr. Carl R. Eklund, Chief of the Polar and Arctic Branch, Earth Sciences Division, Army Research Office, was among 25 polar research officials who recently obtained firsthand information on just how violent weather conditions can be in the Arctic.

The American-Canadian study group helped inaugurate the Army's tunnel town 100 feet below the surface of the Greenland icecap at Camp Tuto last month, and after departing by bus, was halted in a severe blizzard.

Weather conditions were reported in Phase I, suitable for safe travel, when the men entered the tunnel for the ceremonies. But when they left, Phase III conditions, which make traveling extremely hazardous, were prevailing.

The bus in which the group departed from the tunnel was stranded after inching along only 200 yards, quivering in the wind that swept down off the great Greenland Ice Sheet.

The passengers staggered and crawled on hands and knees back to the tunnel. One man was blown down and almost swept into a chasm along the side of the road. Another, a veteran of several expeditions, was temporarily blinded by the snow clogged between his eyes and glasses. He walked into the gap between the parallel spans of a "Treadway" bridge, which was open in the center. His companions hoisted him out before he stepped into the abyss.

Dr. Eklund, who has sledged more than 1,000 miles behind dog teams on a single journey, said, "That was the most harrowing experience of my life." The ARO scientist spent part of his 22nd wedding anniversary clawing his way back to the ice tunnel, which reminded him that he was sent on an expedition to the Antarctic three weeks after he was married. He has been making Arctic expeditions for over 20 years.

Panting from exertion and the almost suffocating effect of the cold air blasts, everyone in the party reached the tunnel safely, after surviving winds of 70 miles an hour.

'Sit Still' Uses Body Heat To Make Sea Water Potable

Survivors of sea disasters dying of thirst may be saved by a device developed by the Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

The device is called the "sit still." It consists of a sheaf of five sheets about the size of a standard typewriter paper with a black plastic film on top, a piece of paper toweling or cloth, a water repellent screen, a sheet of aluminum foil with cloth backing, and a sponge.

The five sheets are dipped in the ocean. Excess water is drained off and the aluminum foil is wiped dry. Reassembled with the plastic film on top, the sheaf is exposed to the heat of the sun or, if it is night or the sky is cloudy, by the heat from the body of a survivor sitting on it.

The heat penetrates to the aluminum foil which is then cooled by the bottom salt-water soaked cloth. In the cooling process a condensation of fresh water forms on the foil. The survivor uses the sponge to soak up the water; it may be only a few drops but enough to keep him alive. The efficiency of the device can be increased by using additional sheets of toweling, screen and foil.

The sit still is the brain child of Dr. Clyde S. Barnhart, an entomologist in the Engineer Laboratories' Sanitary Science Branch.

Body warmth transferred to black-topped sheaf beneath soldier causes condensation, produces fresh water.

Cell Holds Hope of Oxygen for 2-Year Space Flight

Possibility of a chemical system to convert an astronaut's breath into breathable oxygen during space voyages lasting up to two years is being explored at the Battelle Memorial Institute in Columbus, Ohio.

Battelle is readying a prototype model of a rotating electrolytic cell that operates under weightless conditions. The cell will be evaluated by the Aerospace Medical Laboratory.

John E. Clifford, Battelle electrochemist, said well-established principles are used in breaking water down into hydrogen and oxygen in the experimental cell. The ability to operate efficiently independent of natural gravity is the unique feature of the cell, which operates in its own artificial gravity field.

The cell is a drum-shaped unit about three feet high that rotates at up to 500 r.p.m. The cylindrical unit is comprised of 16 individual electrolytic cells stacked one on top of the other. Interspersed between alternate metal plates, which serve as anodes and cathodes, are asbestos diaphragms—thin films that separate hydrogen from oxygen as these gases are generated on the electrodes.

The gases are drawn from the chamber through separate collecting sysetems routed up through the center of the unit. A 500-watt electrical input is required to electrolyze about two quarts of water a day, which is sufficient to provide oxygen for two men.

Development of the zero-gravity electrolytic cell dovetails with the recently announced completion by Battelle scientists of a device that chemically converts the carbon dioxide in an astronaut's breath into carbon and water. The device can use the hydrogen produced by the electrolytic cell, while the cell in turn, can make use of the water to produce more oxygen, Battelle scientists said.

By Dr. Ralph G. H. Siu

R&D PERSONALITIES. One thing about good poetry is its timeless feature. The following random selection of centuries-old Japanese Haikus (17-syllable poetic form) provides an up-to-date description of certain R&D personalities:

Squads of frogs jumped in
When they heard
The plunk . . . plash . . .
Of a single frog. —WAKYU

Lady butterfly
Perfumes her wings
By floating
Over this orchid. —BASHO

Giddy grasshopper
Take care . . . do not
Leap and crush
These pearls of dewdrop. —ISSA

The floating heron
Pecks at it
Till it shatters
Full moon on water. —ZUIRKYU

Night long in the cold
That monkey sits
Conjecturing
How to catch the moon. —SHIK

PUTTING THE ERG ACROSS. The problem of putting scientific ideas into understandable lay jargon seems to plague a lot of us.

Heard about an excellent example of how this can be done. Mr. Leverenz, Associate Director of the RCA Princeton Laboratories, described the erg as the energy expended by a house fly doing one pushup.

LOGIC. Another pillar of the scientific method is logic. Yet, in trying to be logical in our thinking process, we sometimes find ourselves in a bind and do not know which way to turn. This is exemplified by the charming tale of the beautiful maiden, who fell out of her canoe into the hands of the king of the alligators.

The mother tearfully begged for her return. Actually, the king of the alligetors was not such a bad reptile after all. He was quite an intellectual and prided himself, above all, for being an alligator of his word. So he decided to give the old lady a sporting chance. He offered to return the girl if the mother was able to state one true proposition. Without thinking, the mother replied, "You are going to keep my daughter!"

The thinking man frequently finds himself in the same dilemma as the alligator king. If the statement is true that he is going to keep the girl, then he should return her to the mother. And if the statement is false in that he is actually going to release the girl, then according to the bargain, he should not. One can readily see the kind of paradox into which logic can occasionally lead.

Dr. Larsen Picks Army Career Scientist as Deputy

One of the Army's most highly honored Federal Civil Service career scientists, Wilbur S. Hinman, Jr., since 1953 the Technical Director of the famed Diamond Ordnance Fuze Laboratories in Washington, D. C., has been nominated to become Deputy Assistant Secretary of the Army (R&D).

In announcing the nomination, Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen commented that Mr. Hinman follows another eminently respected Federal Civil Service career scientist, Dr. Edward G. Whitting. Secretary of the Army Elvis J. Stahr, jr., presented the Exceptional Civilian Service Award to Dr. Whitting when he resigned in mid-July.

Mr. Hinman's awards include the Harry Diamond Memorial Award of The Institute of Radio Engineers, the Department of the Army Decoration for Exceptional Civilian Service, the Department of Defense Distinguished Civilian Service Award, and the President's award for Distinguished Federal Civilian Service.

Thirty-three years of Government service are back of Mr. Hinman's illustrious career. Born in Washington, Mar. 14, 1906, graduated from Western High School in Washington and in 1926 from the Virginia Military Institute with a B.S.E.E. degree, he immediately thereafter was employed in the graduate student training program conducted by the Westinghouse Electric Corp. for one year.

Following another year of service as a radio engineer with Westinghouse at Springfield, Mass., Mr. Hinman joined the staff of the National Bureau of Standards in July 1928 and was assigned to the late Harry Diamond staff. He advanced through the Federal grades to Chief of the Bureau's Ordnance Development Division in 1950.

The air navigation system of the United States was an NBS responsibility until 1934 and Mr. Hinman assisted in its development. Then, from 1934 to 1940, working jointly with Harry Diamond and other members of the staff, he was prominent in developing the radiosonde system for collecting upper air data currently in use.

Wilbur S. Hinman, Jr.

Development of the radio proximity fuze has been recognized universally as one of the most significant scientific breakthroughs in modern weapons development. In 1940, Mr. Hinman commenced work on the development of the proximity fuze and has continued in this field ever since.

In 1952, he was appointed Associate Director of the National Bureau of Standards, having assumed responsibility for all the military work at the NBS. When the Diamond Ordnance Fuze Laboratories were established in 1953, Hinman became the first Technical Director, retaining this post until he transferred to his new position this month.

Active in the development of a variety of electronic Ordnance equipment, Mr. Hinman holds 11 patents and is the author of 16 papers published in technical journals. Under his guidance activities of DOFL have expanded to many related fields, including nuclear vulnerability of electronic equipment, microminiaturization, fluid control systems.

Mr. Hinman lives with his wife, the former Mary Elizabeth Peebles, of Meridian, Miss., at 333 South Glebe Road in Arlington, Va.

Aluminum, Plastic Balls Tested In Lightweight Turret Bearing

Installation of an aluminum turret ring with plastic balls in a self-propelled artillery vehicle is under test to effect a saving in weight of nearly 60 percent.

Since the new concept of military vehicles calls for increased mobility, air-transportability and droppability, the weight reduction sought by the U.S. Army Ordnance Tank-Automotive Command is important.

In the turret-ring assembly under test, the aluminum bearing is approximately 80 inches in diameter. The plastic balls are made from a polycarbonate resin called Lexan developed by General Motors Corp.

Dependent upon results of the road testing program, AOMC officials envisage a large new field for large aluminum bearings utilizing plastic balls for many new applications.

ERDL Civilian Wins Patent, $100 for Seventh Invention

Kenneth L. Treiber, an employee at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., recently received a patent for his seventh invention.

The invention is a snow saw for dislodging military and other vehicles stalled in polar regions. Letters of patent, along with an honorary award of $100, were presented to him by Col John E. Walker, Acting Director of the Laboratories.

The snow saw is designed to prevent refreezing of the vehicle to the ice or snow, once it has been cut loose. The saw deposits in its own wake a sheet of material that keeps the surfaces from adhering again.

Treiber previously patented a carrying device for generators and other heavy objects, a combined kitchen utensil, a face shield, a release and safety device for collapsible containers, a method of dispensing hose from containers for pipelines, and a 10,000-gallon collapsible petroleum container.

Under terms of the patent, the Government is permitted to use the snow saw without payment of royalties.

Transparency Held Valuable in Preservative Packaging

By Roger L. Keleher, Chemical Engineer,
Research and Development Division, Springfield Armory, Massachusetts

Behind all of the sales promotion potential of transparent packaging, a relatively new but fast-growing method of enhancing sales appeal, is a large field which is not immediately apparent, except to the packaging engineer and to the chemical engineer behind him. This is the field of preservative packaging where transparency is the highly desirable property to be added to the basic preservation requirements.

The very features of transparent packaging that sell this method commercially also have a great deal to offer in the field of military packaging. Transparency in military packaging can bring about large savings in the areas of acceptance, identification, routine care, and maintenance.

In acceptance and identification, packages are often opened for a cursory look to determine the condition of the packaged item or, in the case of identification, merely to assure the man in the depot or field that the packaged item is the one for which he is looking. This can occur when markings are absent, obliterated, unclear, too lengthy, or confusing.

When a package is opened for these reasons, it is not usually properly repacked and the protection afforded may be destroyed. In routine care and maintenance, a definite percentage of stored items must be examined on a periodic schedule. Where this type of maintenance is required, the packages are usually of a Level-A or long-term storage nature.

Obviously, this type of package will be the most expensive. The usual requirements are for greaseproofness, waterproofness, and a low rate of water-vapor transmission.

When this type of package is opened, the barrier material is usually destroyed or discarded. More often than not, the desiccant or volatile corrosion inhibitor within the package is replaced by fresh material. This happens whether the enclosed item is or is not in good condition and is a costly but necessary operation.

Large savings can be realized if transparent barriers can be utilized by the packaging engineer. Three specifications of interest to Springfield Armory are:

1. MIL-F-22191 (Aer) Film, Transparent, Flexible, Heat Sealable.
2. MIL-F-22019 (Aer), Film, Transparent, Flexible, Heat Sealable, Volatile Corrosion Inhibitor Treated.
3. MIL-B-22020 Bags, Transparent, Flexible, Heat Sealable, Volatile Corrosion Inhibitor Treated.

The Armory is presently evaluating materials conforming to the foregoing specifications for more widespread use in small-arms packaging. The VCI-treated transparent films and bags are being used for some of our small-arms packaging. The VCI-treated transparent films and bags are being used for some of our small spare parts, such as pins, springs, plungers, etc.

An excellent Level-A package is made by inserting a transparent bag containing these small parts into a fiber can conforming to specification MIL-C-3955. This package can be opened, material examined through the transparent film, and then reinserted in the fiber container at a large saving of time, labor, and material.

Another attribute is that these materials lend themselves very readily to mechanization. This can eliminate many of the high labor costs involved in some of the present packaging operations where VCI liner, packaged item, and heat seal must, of necessity, be done by hand.

Excellent materials, such as the fluocarbon plastics (still out of the picture pricewise) may be able to compete with present barrier materials through reduction of package labor costs and inspection costs, due to transparency, and in addition contribute materially to increased package strength and durability.

The hoped-for growth in the field of transparent military packaging is based on good solid work by several installations. The Bureau of Naval Weapons has contributed greatly and was primarily responsible for writing the specifications listed earlier.

In the Research and Materials Packaging Laboratory at the Armory, we have been evaluating transparent packaging materials for the past few years. Some of the work has resulted in the limited use of previously mentioned films. Raw data in this test work have not been completely assembled, but demonstrate potential use of this material.

Evaluation was started with what is admittedly a very poor transparent barrier combination and a transparent material which was later found to conform to the requirements of MIL-F-22191, Type II. The poor barrier was a styrene vial with a snap-on polyethylene cap.

Items packaged were various small item spare parts from the U.S. Rifle, Cal. 30, M1. All parts were cleaned by grit blasting, then phosphated, and oiled with a preservative conforming to specification MIL-L-644. Since the styrene vials used were about one inch in diameter and two inches high, a ¾" x 1½" strip of VCI-treated 30# Kraft was inserted in each test package. Several vials were placed in the test with no VCI to serve as controls.

Test packages were made, at the same time, of a transparent film consisting of laminations of polyethylene and polyester. These packs were heat-sealed on four edges. The film packs also contained a strip of VCI-treated Kraft and a newly finished ferrous component. Controls for the film packages eliminated the VCI strips.

All packages were placed in a humidity cabinet operating at 100° F. and 95-100 percent RH for the time periods up to 12 months. An examination of the results showed that the importance of the barrier cannot be underestimated. The inferior vial packs admitted moisture readily and the corrosive effect could not be overcome by oil preservative or VCI. The better polyethylene-polyester film protected the items packaged for two months longer than the vial packages.

With the addition of the VCI strip, reasonable protection was afforded the parts throughout 12 months' exposure in the test cabinet. One month in this test cabinet is believed equivalent to one year in the outdoor-shed storage in the Armory area.

We are at present conducting evaluations using transparent VCI-coated films, vacuum-formed packs containing VCI-oil combinations, and skin packs utilizing VCI on the backing board. At this stage, there is every reason to anticipate that these methods will serve adequately at the intended packaging levels.

Some observations may be made at this time.

- With the exception of fluocarbon resins, the presently known plastics will not afford vapor barriers equivalent to materials conforming to MIL-B-131, but combinations of these materials can yield interesting and useful products.

- Within the near future, fluocarbon resins may be expected to enter the military packaging field to afford transparent barriers that meet Level-A packaging requirements.

• Transparent packaging utilizing vacuum forming, blister, and skin packaging techniques, along with some of the advantages of better preservatives, such as VCI-oil combinations, should find a use at lower cost in almost all levels of packaging.

Missile Markings Clue Engineers on Flight Behavior

Garish colors, candy stripes, barber pole and checkerboard patterns painted on missiles by test engineers of the U.S. Army Ordnance Missile Command and its elements are a prime means of determining how the missiles act in flight.

Viewing films of test firings, missile scientists and technicians study the paint patterns to determine any unusual motion of the missile. They spend hours poring over high-speed photography. The missile markings convey a clear message to those who "read" them.

Standard markings have been devised for Army test missiles, white for the overall coat, jet black for specific markings desired for the test, the same color combination as that followed by newspapers and magazines and for the same reason: the markings show up better.

Deviations from the black on white scheme are sometimes necessary. Special high-visibility paints are used where backgrounds tend to clash with the missiles being tested.

At White Sands Missile Range, N. Mex., where mountains form a purple background and the sand of the desert competes with the test markings, missiles sometimes carry gleaming red noses or tail fins painted in different primary colors.

Small missiles fired on the rocket ranges at Redstone Arsenal, where trees and shrubs form the background, are often given an overall coating of phosphorescent red.

Operational missiles are not so conspicuous. Missiles issued to troops go dressed in olive drab. A camouflage kit is issued with each missile.

Letters are painted on the missiles to be most easily read in the position from which the missile normally is fired; that's why "U.S. Army" reads vertically on some missiles and horizontally on others.

The Army discourages other markings but a distinctive insigne has been approved for at least one missile. The brand new PERSHING ballistic missile is authorized to wear four stars on its sides, the insigne of rank of its namesake, General of the Armies John J. Pershing.

Lt Col Ernst Selected Chief Of Tech-Industrial Liaison

Lt Col Russell W. Ernst, who has been recommended for promotion to the grade of Colonel, has been named Chief, Technical and Industrial Office, Office of the Chief of Research and Development.

Col Ernst served as Deputy Chief, Technical Liaison Office, from Aug. 1, 1960 to Sept. 30, 1961. Prior to that, from July 15, 1959, he was Chief, Pictorial Branch, TLO. He succeeds Col J. E. Shirley, who retired recently and entered private industry.

Born in Louisville, Ky., Apr. 25, 1922, Col Ernst attended Western Kentucky State College from 1939 to 1942, when he entered the Army as a Second Lieutenant of Infantry. He was assigned to the 12th Armored Division and served with that Division in Germany during World War II as S3, 92nd Cavalry Reconnaissance Squadron (Mechanized) from September 1944 to May 1945, and as G3 of the Division from June to September 1945.

ARO Earth Sciences Chief Finally Gains Small Measure of Immortality

Fame, of a fashion, and a mild measure of scientific immortality, such as it is, finally have come to patriarchal, white-haired Dr. Leonard S. Wilson, Chief of the Earth Sciences Division, Army Research Office, OCRD.

After diligently pursuing scientific knowledge for many a year, and in many far corners of the world, the amiable Dr. Wilson has been accorded the distinction of a namesake in scientific annals.

"Why, I'm indeed honored—indubitably and immeasurably!" The Good Doctor remarked when news of the rare honor was relayed by a friend. "And why not? Not every one can lay claim to having a rare scientific subspecies named after him!"

Even when the first report proved somewhat misleading, in that it was presumed that *Bufo vallicepts wilsoni* referred to a previously unknown specimen of the family of frogs, Dr. Wilson remained relatively unsquelched. "All right," he boomed jovially, "not everyone can boast of having a *toad* named after him!"

Announcement of the dscovery of *Bufo valliceps wilsoni* in Jacaltenango, Guatemala, was made in the *Proceedings of the Biological Society of Washington, D.C.*, by Edward R. Baylor and L. C. Stuart of the Woods Hole Oceanographic Institution and the Department of Zoology, University of Michigan. As recounted by the authors:

Dr. Leonard Wilson

"Jacaltenango lies on a terrace of sandstone, high above the Rio Azul, and small depressions in the bedrock fill rapidly and retain water for a considerable period after showers. In these shallow rain-ponds within the village were encountered breeding choruses of *Smilisca beaudini Dumerit and Bibron*, 1841, *Hypopachus championi Stuart*, 1940, and an apparently undescribed race of *Bufo valliceps Weigmann*, 1833. This last it is now our pleasure to describe and dedicate to our good friend Leonard S. Wilson, Chief, Environmental [since changed to Earth] Sciences Division, OCRD, Department of the Army."

An alumnus of the University of Michigan—A.B., M.S. and Ph.D. degrees in Geography in 1932, 1933 and 1936—Dr. Wilson won Earhart and University Fellowships there. Later he served at Carleton (Minn.) College, rising to a full professorship, and also was a lecturer at the University of Wisconsin.

In 1942 he started his Government career as Chief of the Map Information Section, Coordinator of Information. In 1943 he became Deputy Chief, Map Division, Office of Strategic Services, and later was Chief of the Map Intelligence Branch, Department of State. From 1943 to 1947 he served as lieutenant commander in the Navy in Washington, London and Normandy.

Other highlights of his career: Map Officer, United Nations Conference on International Organization, San Francisco, 1945; Geographic Adviser, International Secretariat, United Nations, New York, 1946; Chief of the Geographic Section, G2, Far East Command (also Chief of the Strategic Branch), 1946-1953; Chief, Environmental Research Branch, OCRD, U.S. Army, 1955; Chief, Environmental Sciences Division, Army Research Office, OCRD, 1958.

Author of 26 publications in professional journals, member of many honorary societies, and widely known for his work on high level interservice committees, Dr. Wilson has received the following decorations: U.S. Army Theater of Operations, Certificate for Meritorious Service, 1945; U.S. Army Commendation Ribbon, 1946; U.S. Army Meritorious Civilian Service Award, 1951.

Now it is a matter of historical record that Dr. Wilson, who does a great deal of hopping around in his Army Research Office travels, has another "hopper" named after him.

Frank J. Rizzo, left, and Alvin O. Ramsley, of the Quartermaster Research and Engineering Command, Natick, Mass., received a $200 award and a plaque for the outstanding technical paper published by the American Association of Textile Chemists and Colorists at its annual convention at Buffalo, New York. Mr. Rizzo and Mr. Ramsley, authors of "New Color-Measuring Instruments for Use by the Textile Industry," the prize-winning paper, are shown at the fully automated device which measures and records color differences numerically with a degree of accuracy never before attained. *(See February issue, page 19.)* In August Mr. Rizzo received the Research Director's Award, highest honor for scientific achievement at the QM R&E Command, and a Department of the Army Research and Development Achievement Award.

Receiving the Society of American Military Engineers Certificate of Merit is Capt Harvey L. Arnold, Jr., (left) presented by Col Gerald W. Homann, Commanding Officer, Army Polar Research and Development Command, who won the same honor 10 years ago. Officer-in-Charge of the Army's nuclear power plant at Camp Century, Greenland, Capt Arnold was also awarded a 1-year membership in the Society for being the honor graduate of the 1961 second engineer officer course at Fort Belvoir, Va. He was graduated from the U.S. Military Academy in 1952 and completed graduate work at MIT in 1957.

Army Awards Contract to Ford For SHILLELAGH Development

Continued development of the SHILLELAGH missile system is the basis of an $8,000,000 contract awarded by the Army to the Ford Motor Co.

SHILLELAGH is being developed as a lightweight surface-to-surface guided missile system for close-in combat support to provide increased firepower against armor as well as troops and field fortifications.

System development of the SHILLELAGH system is the responsibility of the Ordnance Tank Automotive Command, Detroit, Mich. Supervision rests with the Army and Rocket Guided Missile Agency, Huntsville, Ala. The Los Angeles Ordnance District is administering the contract.

Navy Chooses Watervliet Arsenal To Build Missile Booster Motors

Watervliet Arsenal has been chosen by the U.S. Navy to build a substantial quantity of booster motors for the surface-to-air missile TERRIER, the principal air defense weapon of missile cruisers and missile destroyers.

Col Walter M. Tisdale, Commanding Officer, said the Arsenal's work on a similar order—building sustainer motors for the Army's NIKE HERCULES air defense missile—was a significant factor in the Navy's selection of Watervliet for the task.

The work will be performed in the Arsenal's missile facility area established last year to handle the NIKE HERCULES job.

8 ERDL Employees Commended, 7 Win Work Performance Cash

Eight employees of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., recently received "Outstanding" and "Sustained Superior Performance" awards.

Three women received both awards, in addition to cash. They are Mrs. Jean A. Berning, Data Processing and Statistical Services Branch, $200; Mrs. June E. Holland, Canadian Liaison Office, $150; and Mrs. Ardell J. Brumit, Publications Section of the Office Service Branch, $100.

Other recipients of cash with their "Sustained Superior Performance" awards are Harry N. Lowe, Jr., Deputy Chief of the Missile and Space Office, $300; Robert H. Bailey, Facilities Planning and Maintenance Branch, $200; E. O. Davis, Technical Liaison Office, $200; and Mrs. Hilda M. Helmcamp, Electrical Department, $150.

Chauncey W. Karstens, Chief of the Petroleum Equipment Branch, received an "Outstanding" rating.

Brig Gen Darnell Heads Reserves

Brig Gen Carl Darnell, Jr., who was nominated Sept. 20 by the President for promotion to major general, has been assigned as Assistant Chief of Staff for Reserves.

Formerly Deputy Assistant Chief of Staff for reserve components, General Darnell succeeds Maj Gen Charles Granville Dodge, who became Army Chief of Information Oct. 1.

Educators Named to ROTC Panel

Three university educators have been named to the 9-man Advisory Panel on ROTC affairs.

They are Dr. Edgar F. Shannon, Jr., president of the University of Virginia; Dr. Benjamin E. Lippincott, professor of political science at the University of Minnesota; and Dr. Herbert E. Longnecker, Tulane U. president.

Mechanized Gunga Din Serves WSMR Desert

". . . a bit of twisted rag and a goat-skin waterbag
"were all the field equipment 'e could find. . . ."

Thus Gunga Din, regimental water carrier, was hailed by Rudyard Kipling.

Times change, and, with them, water carriers and their equipment.

At Stallion Center, sprawling in the sun-baked desert end of White Sands Missile Range, N. Mex., some 100 miles from headquarters, a water detail serves personnel and facilities sprinkled over the north portion of the 100-mile-wide range.

Under the supervision of Sfc William G. Seek, seven drivers operating 13 pieces of heavy equipment—two 5-ton tractors with 4,000-gallon tanks and 11 2½-ton tractors with 1,000-gallon tanks—haul an average of 35,000 gallons of water a day in winter and 60,000 gallons in summer to 66 points.

". . . he could pack and carry one
"'til the longest day was done. . . ."

The Stallion Center water detail is in action 12 to 16 hours a day, six days a week. Each man drives approximately 270 miles a day and averages more than 6,500 miles a month over rough roads that by turn are cold and hot, but always dusty.

Murray Well, in the heart of the vast Tularoosa Basin, is the source of the water that makes life in the desert possible. From it, filled tankers fan out to installations including Stallion, 25 miles away where some 250 men—military and civilians—are stationed, Oscura Range Center—136 miles round trip—and Salinas Peak, 50 miles away and towering more than 9,000 feet above sea level.

In addition, they take water to numerous range facilities where sensitive electronic equipment must be kept at specific, even temperatures by air conditioning, even when not in use.

"In winter, the wind here is biting cold; in summer, it is burning hot, but always wind and always dust," Lt Col J. A. Snow, commander of Stallion Center and Detachment 5, summed up. "But, the men are doing an important job and doing it well."

Due to the narrow, winding road and steep climb to Salinas Peak—the snaking white road is visible almost 80 miles away—two vehicles are dispatched together.

"Near the base of Salinas Peak, the road incline becomes so steep that a 5-ton tractor with a load of water can't pull it. So, in addition to safety reasons, a 2½-ton goes along to push the 5-ton to the top," Sgt Seek said.

Dotting the range, like huge white beehives, are astrodome shelters housing missile instrumentations. Each shelter is equipped with an air conditioner to protect the expensive implements it covers. These air conditioners use approximately 300 gallons of water a day, and Stallion's Gunga Dins fill the storage tank at each facility every other day.

Drivers rotate on routes with the longest tour—10 days—on the Oscura Peak run. Drivers get receipts for each load of water delivered, and records are kept on just how many and where each gallon is left.

Four large storage tanks keep a ready supply of water at Stallion, the largest installation. Approximately 15,000 gallons a day are used at Salinas Peak, but when the installation now under construction at the top of the peak is completed and personnel strength is increased to 60, water requirements will increase to 25,000 gallons a day.

Commented Kipling: ". . . you're a better man than I am Gunga Din." But not the equal of the Stallion Center water detail men.